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VIEWS, NEWS AND INTERVIEWS.

Mrs. Potheavy now wants to know if electrical plants grow in magnetic fields.—*London Electricity.*

No, they don't. But in some cases, magnetic fields grow in electrical plants.

Horse racing by electric light is to be introduced at the Chester Park race track, near Cincinnati.

In reply to a suggestion made by the *American Machinist* that all steam fire engines should be self-propelling, a correspondent proposes that fire engines be operated by electricity. His fire engine would be an electric pump mounted on a light truck. A system of electrical supply similar to a lighting system would furnish current. Switches enclosed in accessible boxes on the streets would be distributed the same as the fire hydrants. After the engine had been run to the fire, presumably by horses, connection between the electric pump and the street switch would be made and there you are.

The proceedings against Dr. Cornelius Herz, electrician and alleged canal swindler, have been abandoned. He may be easy in his mind now, but doubtless his recollection of the past often herz.

An English publication, *Pearson's Weekly*, is responsible for this: "Mica is chiefly made use of for dynamos, electric alternators and transformers, and also for placing at the ends of cables for the purpose of absorbing the electricity which lingers in the wire after a message has been sent, the presence of which would affect subsequent messages."

"Dr." William R. De Krafft, who has a private hospital at 30 West Thirtieth street, New York, where he prescribes a "magnetic-electro" treatment, was locked up last week on a charge of swindling one of his patients out of $10,000.

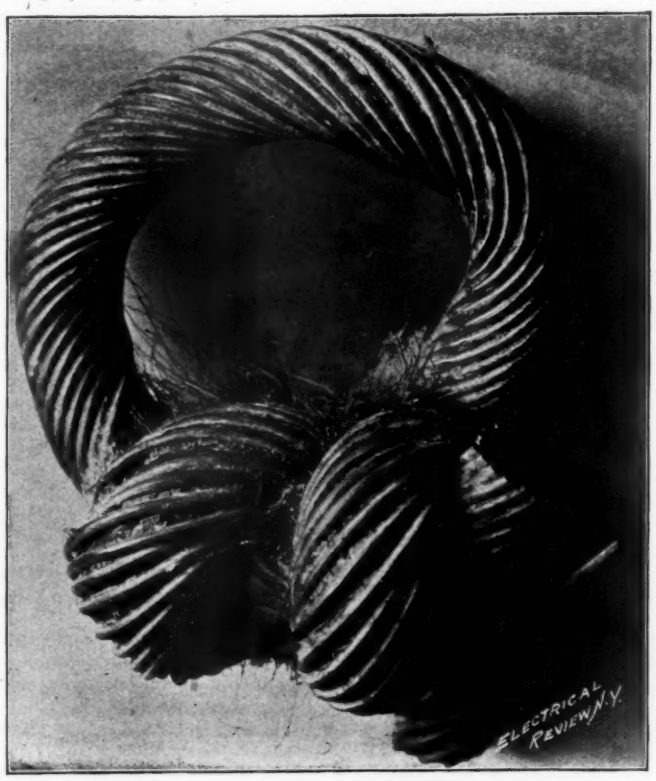
Seven year old Harriet Kitchell, who was knocked down by a Myrtle avenue trolley car in Brooklyn, N.Y., and had the thumb of her left hand cut off, has received a verdict for $2,000.

Prof. Alexander Graham Bell is at his Summer place in Nova Scotia, where he is reported to be engaged in a series of investigations which may have important results. His out-door work is devoted to experiments in aerial navigation in connection with Professor Langley of the Smithsonian Institution, while in his laboratory he is endeavoring to work out a scheme for seeing at a distance by means of electricity.

During a fire in the British navy yard buildings on Ireland Island, in the Bermudas, an admiral directed the operations of the fire department by telegraph from Halifax, Nova Scotia, 900 miles away.

In reviewing a recent account of Nikola Tesla's writings and researches, Prof. W. A. Anthony alludes, in the *Physical Review* for May-June, to Tesla's assertion, in a recent London lecture, that "ere long intelligence—transmitted without wires—will throb through the earth like a pulse through a living organism." To this the writer remarks: "How many people could use the earth at once? Would not the telephone girl's frequent answer, 'line in use,' have to be accepted in that case as at least plausible?"

The Western Union Telegraph Company has been sued for damages arising from another undelivered message. The brother of a bank cashier in Alabama gave him warning that a band of desperadoes was on the way to kill him. The telegraph company failed to deliver the message, and the executors of the murdered man are suing it for $20,000.



A KNOT CUT FROM A SUBMARINE CABLE IN HAMPTON ROADS, BELONGING TO THE SOUTHERN BELL TELEPHONE AND TELEGRAPH COMPANY.

A BADLY TWISTED TELEPHONE CABLE.

TIED IN A KNOT BY A SHIP'S ANCHOR, BUT IT WORKED JUST THE SAME.

The illustration on this page shows a knot cut out of an Okonite submarine cable which was laid about five years ago from the government pier at Fortress Monroe, Va., across Hampton Roads to Willoughby Spit. The cable belongs to the Southern Bell Telephone and Telegraph Company. Just at this place in Hampton Roads the water is very deep and very swift. During the Winter an ice jam formed and forced the ships lying in the Roads to drag their anchors. A ship's anchor caught the cable and broke it. When it was hauled up for repairs this knot and several others were found. Until the break occurred the cable had worked perfectly and, in fact, examinations and tests made on this knot show the conductors and insulation to be in perfect order and the resistance as high as ever, although the iron armoring is badly strained.

Get to Work on Rapid Transit.

Now that the Chamber of Commerce bill has become a law by the approval of Governor Flower, no time should be lost by the new commissioners in taking up the matter of rapid transit for New York city and pushing it vigorously. The first duty will be to adopt a system and routes, and offer the franchise to private capital. This may be undertaken at once, since the law authorizes the construction of a road by private capital without waiting for a vote of the people. If private enterprise can be induced to undertake the project on satisfactory terms and conditions so much the better. If it cannot then it will be for the people to say at the polls next November whether public money shall be used for that purpose. New York city is nearer to rapid transit than ever before.

Notwithstanding the many difficulties which have had to be overcome, good progress is being made with the construction of the electric street railway in Madras, India.

UNIPOLAR DYNAMOS FOR ELECTRIC LIGHT AND POWER.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, PHILADELPHIA, MAY 16, 1894, BY PROF. FRANCIS B. CROCKER AND C. H. PARMLY.

INTRODUCTION.

The object of the present paper is to call attention to the fact that unipolar dynamos and motors are much more practical and generally applicable than is ordinarily supposed to be the case. The term unipolar dynamo is here used in its ordinary sense to designate a machine in which electric

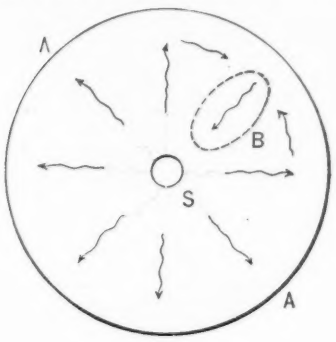


Fig. 1

currents are generated by the continuous cutting of lines of force. These machines are identical in principal with the original disk machine of Faraday. The term unipolar is by no means satisfactory, but is almost universally used in connection with machines in which the magnetism in the armature is not reversed by the rotation of the latter. In this broad sense, however, it is also used to include machines of the Mordey and other types in which the lines of force always pass through the armature in the same direction; but in these machines there are separate pole pieces and the lines of force vary in the armature just the same as in the ordinary bipolar and multipolar types. Moreover, machines of this kind usually have their armatures wound with many turns of wire, they require a commutator in order to generate direct currents, and are radically different in principle from the continuous cutting machines which are the subject of this paper.* The term "non-polar" suggested by Forbes is preferable to unipolar, but it is rather meaningless and is liable to be understood to mean any kind of ironclad machine. Unipolar dynamos are also called disk or tube machines since the armature is usually made in one or the other of these forms. Neither of these terms, however, covers the other and they are liable to be confused with other types of machine, similar in form but different in principle. The authors suggest continuous pole dynamo as a good name for this type of generator.

HISTORICAL NOTES.

The first machine of the unipolar type was Barlow's Wheel described by him in 1823 and consisting of a star-shaped disk with long points revolving between the poles of the magnet. A current was passed through the particular portions of the disk between the poles of the magnet and the disk was thereby caused to rotate. This apparatus was therefore the first unipolar motor. Faraday's disk machine, constructed and described by him in 1831, was the prototype of the dynamo and was also a unipolar machine.* He also made an apparatus working upon the same principle but consisting of a copper cylinder suspended over and revolving around the pole of a bar magnet. This was the first form of tube dynamo.† Faraday even at that early time appreciated the difficulty of obtaining a sufficiently high electromotive force from generators of this type, and attempted to accomplish it by having several disks placed side by side and revolving in opposite directions. Similar ideas have been reinvented time after time, and even at present it is a favorite field for invention. For many years after Faraday's discoveries the unipolar machine was almost neglected, progress being in the direction of machines having many turns of wire in the armature to obtain a high electro-motive force. In 1878 Siemens constructed a unipolar machine with a tube armature of considerable size for actual commercial use in electro-metallurgy. Delafield showed at the Philadelphia Electrical Exposition of 1884 a unipolar dynamo of the tube type which generated currents of few volts and a large number of amperes. Forbes has also constructed and described unipolar machines in which the armature is in the form of a cylinder of iron revolving within a field magnet, which completely surrounds it. The mechanical and magnetic design of this machine is very ingenious, and from the practical standpoint it was a considerable improvement upon anything which preceded it. The highest electro-motive force obtained from these machines appears to have been about six volts, and nothing further has been heard concerning them for several years. The complete neglect into which this type of dynamo has now fallen is best proved by the fact that no example of them was shown at the Chicago Exposition. In fact, it might be said that their present importance is actually negative, since the only attention which has been given to them lately consists of a few articles on "Unipolar Dynamos which do not work," that appeared in the electrical journals during the past few months.

GENERAL PRINCIPLES.

The action of unipolar dynamos is based upon the fact that a conductor moving in a magnetic field so as to cut lines of force will have an electro-motive force set up in it whether the field be uniform in intensity or variable. The error is very commonly made of supposing a variation in the number or density of the lines of force is necessary in order to produce a current by magneto-electric induction. As a matter of fact, however, an electro-motive force must always be produced if any lines of force whatever are cut. It may happen, and in the case of a coil of wire it usually does happen, that lines of force are cut in one direction by one

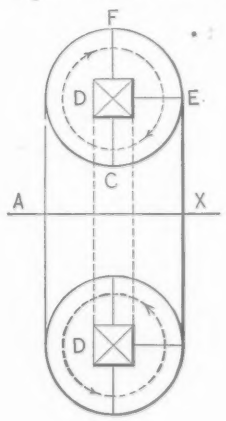


Fig. 2

portion of the conductor and in the opposite direction by the other portion, in which case one effect neutralizes the other. The simplest example of this is a closed metallic ring moving in a uniform field perpendicular to the lines of force. In this case one-half of the ring generates an electro-motive force in one direction and the other half in the opposite direction, so that no *current* is produced; but the full difference of potential corresponding to the number of lines cut per second will, nevertheless, exist between the two sides of the ring.

In the unipolar dynamo or motor a variation in the lines of force is not only unnecessary, but is positively objectionable, since it would cause serious losses from eddy currents and hysteresis, whereas if the field is perfectly uniform these losses are practically avoided.

Any break or weakening of the intensity of the field, due to "blow holes" in the casting for example, would allow the armature current to flow back at that point and would act as a sort of short circuit on the rest of the armature. For example in Fig. 1 let A A represent a disk armature revolving upon a shaft S. The field is of uniform intensity and an equal electro-motive force is generated at each radius as indicated by

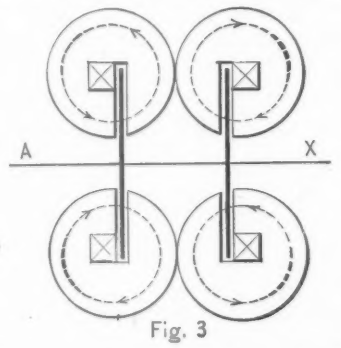


Fig. 3

the arrows, except that the portion B of the armature is in a weaker field. In this case the current will flow back through the portion B as indicated by the arrow, and the armature will be like a short-circuited one of the ordinary kind. This back current will flow and produce heating and loss of energy even though the external circuit be open.

It is also a common error in regard to unipolar machines to suppose that the armature cannot be made of iron. As a matter of fact, iron or steel is usually better than copper, because it is a much better conductor of magnetism and the reluctance of the magnetic circuit can be reduced far below what is possible with a copper armature, the only air gaps being the small mechanical clearances required for free rotation. A steel or wrought iron armature is much stronger than one of copper, not only on account of its greater strength for the same thickness, but also because it can be made much thicker without causing any appreciable increase in the reluctance of the magnetic circuit, whereas a copper armature would have to be made very thin. The greater specific resistance of iron is not objectionable since an armature composed of it would have a current capacity far greater than is required, and the thickness can be increased to make up for the higher specific resistance.

METHODS OF MULTIPLYING THE ELECTRO-MOTIVE FORCE.

The plan suggested by Faraday was to have two or more disks side by side revolving in opposite directions, the edges being connected together by mercury or other contacts so that the current flows outward from the center to the periphery in one disk, inward in the next disk, and so on in series. In this way it is possible to multiply the voltage as many times as there are disks, but there are obvious mechanical difficulties in rotating these disks in opposite directions, and the numerous electrical contacts would be decidedly objectionable. Hundreds of modifications of this idea have been suggested, for example, Siemens, in the tube machine already referred to, multiplied the electro-motive force by splitting the tube longitudinally and placing rings on the end of the tube so that the current was carried first through one section of the tube, then through another, and so on. In this way the circuit may be threaded through the magnetic field a number of times, each time a certain electro-motive force being added. Another plan to accomplish the same result would be to have a number of thin tubes placed concentrically one within the other, but separated by a layer of insulating material, and connected so that the current passes first through one tube, is then carried around outside of the machine and is passed through another tube and so on through all of them in series.

There is no theoretical limit to multiplying the voltage by some such method, but practically any of these constructions would have very serious, if not fatal, mechanical and electrical difficulties. It would seem to be far preferable to construct the machine of sufficient size and run it at sufficient velocity to get the required voltage without complicating the construction. There is no objection, however, to connecting two unipolar machines in series, both being driven, for example, by one engine, which may be belted or direct coupled, and there is no serious complication involved in operating four or even more machines in series. The first cost and attendance required would probably be much less with four unipolar machines than with one direct current machine of the ordinary type.

One very convenient way to multiply the voltage of a dynamo would be to charge a number of storage batteries by means of a low voltage machine of, say, 10 or 20 volts. When charged, these batteries could be connected in series to give any desired electromotive force, 115 or 230 volts for example, and the actual working current would be supplied by them. The charging could be done at hours when the current was not required, or two batteries could be used alternately to give an uninterrupted supply of current. In this way two advantages could be realized, first the cheapness and simplicity of the unipolar dynamo, and second, the uniformity of load with which the engine and dynamo could be run.

PRACTICAL DESIGN.

It is not difficult to get up complicated puzzles in connection with peculiar forms of unipolar machines, but in the simple and probably the only practical forms, we have a single straight conductor which cuts all the lines of the magnetic field once per revolution. In the case of the disk machine we can consider any radius of the disk as constituting the conductor, and in the case of the tube machine it is any element of the cylinder.

The theory of the magnetic circuit is now well understood, and modern practice in the design of dynamos and motors fully appreciates the advantages which result from making the ratio between the length of the magnetic circuit and its cross-section a minimum. In a unipolar dynamo this reduction of the reluctance of the circuit can be carried farther

*. The term unipolar is also applied to the Ball dynamo, but this also acts like an ordinary bipolar machine, except that the magnetic circuit is completed through the air and it is in no sense a "continuous cutting" machine.

*. Experimental Researches, Vol. 1, Art. 85.
†. Loc. Cit., Art. 219.

than in any other class of machines, because the creation of an electro-motive force by the continuous cutting of the lines of force, enables a form of magnetic circuit to be employed which in the highest degree combines the advantages of minimum length with maximum cross-section. This type of magnetic circuit is the circular ring; for if we surround a circular coil D D of wire carrying a current, with two circular rings of semi-circular cross-section, as shown in Fig. 2, we shall form a closed magnetic circuit of maximum induction for minimum excitation. Cut this circuit along any radius of the circular cross-section and a magnetic field is obtained in which, if an inductor be rotated about A X as an axis, there will result a continuous cutting of the

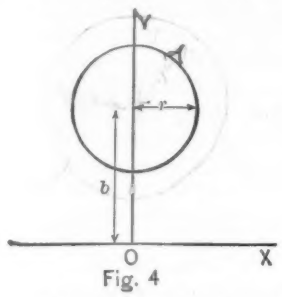


Fig. 4

lines of force, which only requires that appropriate collectors be provided to form a closed electrical circuit in order to produce a current of electricity. The magnetic circuit is indicated by dotted circles with arrow heads.

There are, however, but two directions in which the magnetic circuit can be cut so as to form a field suitable for practical use. One is along the radius C D, in which case the inductor will rotate in a plane perpendicular to the axis, and the other is along the radius E D, in which case the inductor will move in the convex surface of a cylinder whose axis is the axis of rotation. In the first case the armature of the resulting dynamo will be a disk, and in the second case a cylinder. In both, the way to collect the current would be to provide one set of collectors at the center of the edge of the armature and the other set at the axis, thus utilizing the shaft as a portion of the electrical circuit. The relative advantages and disadvantages of the two forms depend upon circumstances in each particular instance.

In many cases the single magnetic circuit shown in Fig. 2 is not the

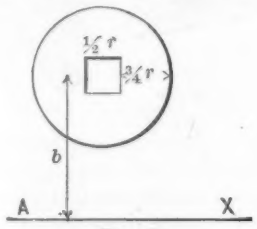


Fig. 5

best for practical use, because it would be necessary to make the diameter of the ring larger than it would be if two rings were placed side by side, as shown in Fig. 3 and Fig. 7, because in this type of dynamo we must depend wholly upon the total magnetic induction and the speed of rotation to produce the electro-motive force, as it does not appear to be practicable to greatly multiply the voltage by multiplying the number of inductors.

Another consideration of importance is the volume of the ring. It is evident that any required area of pole surface can be provided by keeping the mean diameter of the ring constant and varying the radius of the circular cross-section between certain limits, or by keeping this radius constant and varying the mean diameter of the whole ring. It is also evident that for any particular required area of pole surface any decrease in the mean diameter of the ring requires a corresponding increase in the radius of the circular cross-section and vice versa. In Fig. 4 let the circle whose radius is r and the distance of whose center from the axis of X is b revolve about that axis generating a volume of revolution. This volume forms the field magnet and contains nearly all the weight and a large part of the cost of the machine. This volume, which is an annulus, may be determined by the centrobaric method, according to which a volume of revolution is equal to the generating area multiplied by the circle described by its center of gravity. Hence the volume

$$V = 2\,\pi^2\,r^2\,b \ldots\ldots\ldots\ldots (1)$$

The factors r and b must have certain values in order to produce the required electro-motive force, the latter being usually the definite object for which a dynamo is designed. The values of r and b are found as follows:

Let E = the required electro-motive force expressed in volts.

Let n = the number of revolutions per minute.

Let B = the number of magnetic lines per square inch.

Let A = the number of square inches of pole surface.

Let r = the radius of the circular cross-section of the ring expressed in inches.

Then because the two rings are wound so that the electro-motive force due to the field of one is added to that due to the other, each ring must be designed to provide enough lines to generate only $\frac{E}{2}$ volts. This requires that $\frac{E}{2} \times 10^8$ lines must be cut per second, or $\frac{E}{2} \times 10^8 \div \frac{n}{60}$ per revolution. Hence the number of square inches of pole surface needed is

$$A = \frac{30\,E \times 10^8}{n\,B} \ldots\ldots\ldots (2)$$

As shown in Fig. 3, the core of the ring will be utilized for the exciting coil, and for simplicity of construction we shall make its cross-section square. It is desirable to keep the size of this square as small as possible, because any increase in the length of a side increases the diameter of the circular cross-section an equal amount, and therefore enormously increases the volume, which is proportional to the second power of this diameter. But this square cannot in practice be made indefinitely small, because too great a concentration of the lines immediately surrounding the coil must be avoided and space enough provided to give ample excitation. One-half of the radius appears to be a length suitable for the side of this square. Referring to Fig. 5 we shall then have an area of pole surface

$$A = 2\,\pi\,b\,\tfrac{3}{4}\,r \ldots\ldots\ldots\ldots (3).$$

But we have seen in equation (2) that we need an area equal to $\frac{30\,E \times 10^8}{n\,B}$, hence equating this with the above value of A we have

$$2\,\pi\,b.\ \tfrac{3}{4}\,r = \frac{30\,E \times 10^8}{n\,B}.$$

The ratio between b and r, which seems to best fulfill the conditions of good design, is $b = 2.5\,r$. Making this substitution above and designing so that $2\,b$ equals the outer diameter D of the armature, we have

$$D = 10^8 \sqrt{\frac{2\,E}{\pi\,n\,B}} \ldots\ldots (4)$$

which shows that the dimensions of the machine are directly proportional to the square root of the required electro-motive force, and reciprocally proportional to the square roots of the speed and of the magnetic induction. It is to be further observed that since for machines varying widely in their outputs B is nearly constant, the most important ratio in equation (4) is $\frac{E}{n}$. In the design of a machine for any special voltage, however, E is fixed, and therefore the only arbitrary quantity is n: so that the whole problem is to determine the values of D and n which gives the best design.

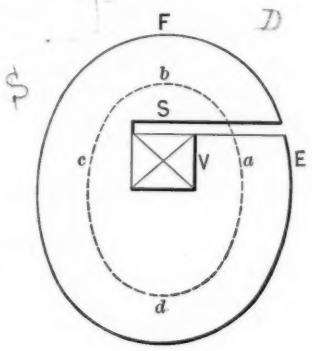


Fig. 6

Let v = the peripheral speed in feet per second; then we have

$$v = \frac{\pi\,n\,D}{720}$$

whence $$D\,n = \frac{720\,v}{\pi} \quad (5)$$

Substituting in this equation the value of D given by equation (4) we have

$$n = 0.00000825\,\frac{v^2\,B}{E} \quad (6)$$

and $$D = \frac{10^8}{36}\,\frac{E}{v\,B} \quad (7)$$

from which the values of D and n can be immediately determined for any prescribed values of E, B, and v.

The maximum velocity in feet per second which the rim of a fly-wheel may with safety attain is given by the equation*

$$v = 3\,\sqrt{t}$$

where t is the safe stress of the metal in pounds per square inch. If the inductor be of wrought iron or of steel for which $t = 10000$, we shall have $v = 300$; and if of cast iron for which $t = 5000$, we shall have $v = 210$ nearly. The much higher permeability of cast steel over cast-iron, and its comparatively small additional cost make it the metal most economical to use, and we shall therefore assume that the inductor is either of wrought-iron or of cast or forged steel. Hence making $v = 300$ in equation (5) we find that the maximum value which the product $D\,n$ can attain is $D\,n = 68750$. This then is a condition which must not be exceeded in order that the design shall be mechanically safe. Making $v = 300$ in equations (6) and (7) we have

$$n = .7425\,\frac{B}{E} \quad (8)$$

and $$D = \frac{10^7}{108}\,\frac{E}{B}. \quad (9)$$

If the armature were made of forged steel it would be allowable to assume t to be as high as 20,000 since the armature is entirely enclosed and could do no harm even if it burst. In this case $v = 423$.

We have now to deduce a formula for the number of ampere turns required to produce the necessary excitation. As a first approximation and to enable us to determine the general conditions, the cross-section of the ring was assumed circular. In practice, however, this form of section must be modified, for a reference to Fig. 2 shows that in order to give the same area of cross-section perpendicular to the direction of the lines of force at D C and D F as at D E we must cause the circular cross-section to bulge out on the side toward the axis and contract on the side away from the axis.

On account of the diminution of cross-section due to the air gap and to the holes for the brushes it is found necessary, however, to preserve for the outer portion of the ring a semi-circular cross-section and it ultimately assumes the form shown in Fig. 6.

The mean length of the magnetic circuit is therefore the length of the semi-circle $a\ b\ c$ plus the length of the curve $a\ d\ c$. Assuming the air gap to be $.06\,\sqrt{D}$ we have the data for determining the ampere turns required.

The amount of current which the dynamo can generate is determined by the carrying capacity of the armature and brushes. Since $.2\,\sqrt{D}$ may be assumed to be the thickness of the inductor we have for the current carrying cross-section of the armature

$$.2\,\pi\,\sqrt{D^3}$$

square inches. Since iron or steel would carry at least 200 amperes per square inch the current capacity of the armature is

$$C = 40\,\pi\,\sqrt{D^3} \ldots\ldots (10)$$

which at E volts gives the capacity of the machine in watts

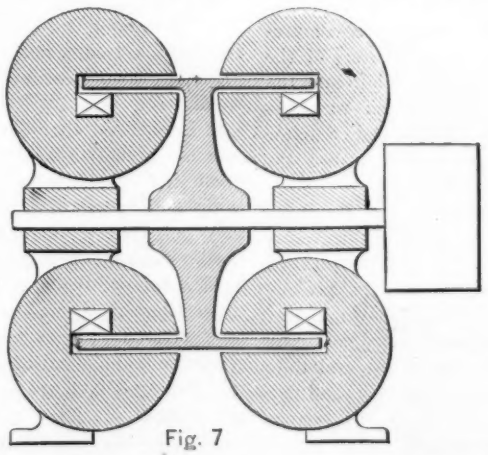


Fig. 7

$$W = 40\,\pi\,\sqrt{D^3}\,E \ldots\ldots (11)$$

To show the application of these formulæ to two widely different classes of machines let it be required:

First—To design a belt-connected dynamo to generate ten volts at 1,200 revolutions per minute for electro-metallurgical purposes. Making field-magnets and armature all of cast steel and taking the induction B at 90,000 lines per square inch we have

(Concluded on page 270.)

* Thurston, "Manual of the Steam Engine," Part II, Art. III, p. 422.

RAPID TRANSIT FOR NEW YORK.

GOVERNOR FLOWER SIGNS THE BILL WHICH IS FULL OF PROMISE FOR NEW YORKERS — A SYNDICATE READY TO BID.

Governor Flower signed the Chamber of Commerce rapid transit bill on May 22. In his memorandum of approval the Governor analyzes the provisions of the bill, and while he expresses some doubt about the success of the novel and rather intricate

FIG. 1.—GENERAL ELECTRIC COMPANY'S PORCELAIN FLOOR AND WINDOW TUBE.

scheme proposed by the bill, he expresses his willingness to give the measure his approval, particularly as its main provisions are to be submitted to a popular vote. The Governor also takes up the constitutional objections which have been filed with him against the bill and concludes that in view of recent decisions of the courts they are not of sufficient importance to warrant him in withholding his signature.

The commissioners named in the bill are the Mayor and Comptroller of New York city, the president of the Chamber of Commerce, *ex-officio*, and William Steinway, Seth Low, John Claflin, Alexander E. Orr and John H. Starin. It is said that Mr. Orr will resign and that Charles S. Smith will be appointed in his place.

The rapid transit bill was one of the most thoroughly discussed measures in the legislature. The Sheffield bill, which the Governor has signed, was the result of a compromise between the supporters of the Chamber of Commerce bill and the Workingmen's bill, which was presented by Mr. Butts and Senator Lexow. The referendum clause was part of the latter measure.

The bill signed by the Governor provides that the newly created commission shall take up the work of securing transit where the present commissioners laid it down. But under its provisions more power is granted to the new board, and they may determine that the city shall pay for the construction of the system and lease its operation.

If the board should determine that it is expedient that a rapid transit road should be constructed at the expense of the city it is authorized to use any plan which has been heretofore adopted by the present Rapid Transit Commissioners and which has received the constitutional assent of the legal authorities and the property owners or of the General Term of the Supreme Court in case the property owners shall have refused their consent. Or it may proceed to devise and adopt new routes and plans, which must in turn be submitted to the Common Council and to the property owners or to the General Term of the Supreme Court for the requisite approvals.

When the plans are finally adopted and consented to, the board is authorized to advertise for proposals for the construction and operation of the road. Power is given to the commissioners, if they see fit to do so, to make one or several contracts for the construction of an entire system or parts of a system of rapid transit.

The successful bidder is then required to enter into a contract for the construction of the road, and also to equip, maintain and operate the same for a term of years to be specified in the contract, not less than 35 nor more than 50 years.

The annual rental to be paid by the contractor to the city must be an amount, to be fixed by the commissioners, not less than the interest on the bonds issued by the city to pay for the construction of the road, and

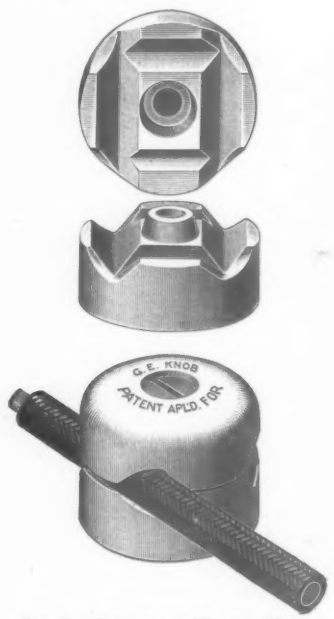


FIG. 2.—PORCELAIN WIRING KNOB.

an additional sum, not less than one per cent, upon the amount of the bonds.

It is reported that a strong syndicate of capitalists is all ready to bid upon the franchise to construct, equip and operate the system when they get the opportunity. Austin Corbin was recently said to be at the head of this syndicate, and the stories connecting his name with it have been revived. It is said that the syndicate is composed of 20 men who will put up $50,000 each and secure the contract.

Although the Brooklyn Heights, N. Y., Railroad Company succeeded recently in stealing a march on the Prospect Park police, and erecting four trolley poles in Ocean avenue, they will not be allowed to string their wires without a legal fight. The city authorities have revoked the permit given to the company to put up the wires, and will contest the right of the company to operate a trolley line in the avenue.

TOLL SUBSCRIBERS.

THE METROPOLITAN TELEPHONE AND TELEGRAPH COMPANY'S NEW SCHEDULE OF RATES.

The officials of the Metropolitan Telephone and Telegraph Company have for some time been discussing the plan of presenting an additional schedule of rates for subscribers to the telephone service. The plan agreed upon will go into operation in a few weeks, and while it does not change the present rates, gives new subscribers, as well as old subscribers on the expiration of their present contract, the privilege of paying for the service an amount based on the number of messsages.

The great demand for public pay stations indicated to the watchful officials of this company that there was a field for such service. There are now over a thousand pay stations in New York city. The new rates will be a charge of $150 for a thousand messages per annum, and a stated price for each additional 100 that may be desired. Subscribers can contract for any number of messages in addition, and the rate to be charged will be in accordance with the schedule which is now being carefully worked out. For $150 the subscriber receives the present improved metallic circuit instrument, and will have all the rights of the regular subscriber, paying toll, of course, for out of-town messages. The plan is a very excellent one, indeed, and wherever adopted it will do away with deadhead telephoning. A lower rate still is known as the two-party line, on which two subscribers can be placed on one line. The rate for this service will be $100.

The Metropolitan Company now has nine exchanges in the city proper and one small exchange at Tremont, above the Harlem. Ten thousand two hundred and fifty telephone subscribers daily use their telephones in this city, and about 75 per cent of these have the improved metallic instruments. Over 30,000 miles of telephone wire are underground in New York, and each subscriber not only has the privilege of talking with the 10,000 others, but, by paying toll, can converse with probably 150,000 other telephone subscribers in other territories covered by the Long Distance telephone system.

The Harlem exchange and the entire Harlem plant is to be rebuilt this Summer, and this will greatly improve the service in that part of the city.

President Cutler and General Manager Bethell are to be congratulated on this forward movement in the telephone field. While it greatly increases the work of recording, bookkeeping, etc., it adds a flexibility to the service that cannot fail to attract a great many new subscribers.

Our New Dress Appreciated.

My congratulations to the ELECTRICAL REVIEW, of New York, which has blossomed out in new and attractive type. It look ever so much better in its new get up.—*London Electricity.*

The Telephone.

[*Philadelphia Star.*]

Let us think of the habits of concise expression to which the public is educated by the quiet ministrations of the telephone. Let us ponder on the fact that it is possible to call a directors' meeting in Chicago, in which some of the directors present are in New York and others in Boston, and to transmit the business of the hour in such a meeting with facility and dispatch, or on the enormous amount of travel, with the consequent loss of time, saved by the existence and availability of the telephone. The side influence of this wonder-working invention is not less important; its use in mines and by the submarine diver; its influence in physics and surgery, and as an instrument of philosophical research, in telegraphy without wires, and in scientific measurement. How great is that influence, considering the youth of the invention! How infinitely small measuring the future by the light of the geometrical progression of rate of progress of the past!

General Electric Company's New Porcelain Wiring Appliances.

The General Electric Company has lately designed certain new porcelain wiring appliances, illustrated herewith, to meet the insurance requirements. The cleat is formed of two pieces exactly alike, in which the groove is so shaped that it will take a wire up to $\frac{5}{16}$ inch in diameter, and the wires are 2½ inches apart, as specified in the insurance rules. The knob is designed to hold wires from $\frac{5}{16}$ to ½ inch and do away with the unsightly

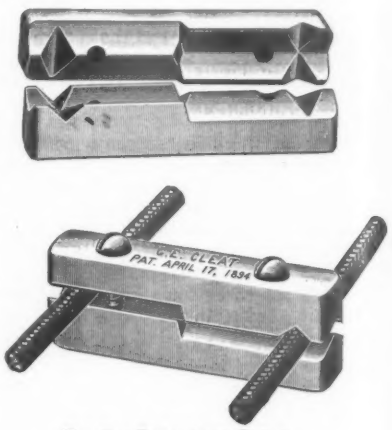


FIG. 3.—PORCELAIN CLEAT.

tie wire. The top and bottom are each provided with four grooves of different dimensions so that any wires within the range given may be firmly secured. This knob is 1½ inches high and 2 inches in diameter, the wire being held ½ inch from the ceiling. The floor and window tube has a central hole ⅝ inch in diameter and a head 2¼ inches in diameter. It is 1⅜ inches outside diameter and 3¾ inches long. These porcelain appliances, like all the others made by the General Electric Company, are of the best, hard, white, vitrified, non-absorbent porcelain of highest resistance.

The trolley is being substituted for horse-power in the street railway system of Norfolk, Va.

Telephone Rates and Dividends.

The Metropolitan Telephone Company, of New York, and the Southern New England Telephone Company are considering the question of telephone rates, and as to how far the Buffalo toll system can be applied in New England, and to larger cities. In the Buffalo system the charges for a telephone are according to the number of telephone calls.

Some experimental telephones will be put into New York city offices based upon the Buffalo system, by which beyond, say, 1,000 calls per annum, tolls are charged.

When a plan of toll service for telephone subscribers has been worked out it will probably lead to concentrated action by all the exchanges operating through the American Bell Telephone Company.

The following figures compiled from the annual report of the New England Telephone Company may be of general interest as indicating the rising tides of expense, maintenance and construction.

	1893	1892	1891	1890	1889
Maint e- nance.	$570,866	$480,994	$412,607	$361,032	$329,946
Op. ex.& taxes.	525,770	442,541	395,708	340,197	327,535
Rentals.	323,263	313,877	289,473	259,976	241,756
Interest.	121,902	101,667	76,280	42,408	22,337
To'l ex	1,560,080	1,365,122	1,189,722	1,045,037	957,305
Newcon- strct'n	357,067	336,204	496,290	403,490	331,192
Total rec'it.	2,042,748	1,801,566	1,559,345	1,383,667	1,255,570

It would appear by the above that without a "construction" account there could be no dividends upon the investment. Throughout the country the changes and growth in the telephone service calls for more capital each year than the entire net earnings. From the parent Bell Telephone Company and down to the local exchanges there are, says the Boston *News Bureau*, in a sense no real dividends or divisions of earnings upon which stockholders may live.

All dividends and more are called back from stockholders to go again into the public service, and all the stockholder finally gets is a paper certificate representing "bookkeeping." If this has any premium value the public legislators or the corporation commissioners will very likely want a second division with the public through non-division of surplus or stock—by auction sales.

Queen & Company's New York Branch.

The many friends of Mr. G. S. Woolman, so many years engaged in the scientific instrument business at 116 Fulton street, New York, will be interested to learn of an important change in his affairs. The firm of Queen & Company, of Philadelphia, with whom he was connected earlier in life, having found it necessary, owing to the great volume of their business in the vicinity of New York, to establish a branch there, have purchased Mr. Woolman's entire business and have secured his services as their New York manager. From the Philadelphia staff of the electrical department, Mr. O. T. Louis, formerly in charge of resistance standardization in Queen & Company's laboratory at Ardmore, has been detached and stationed at the New York office.

Mr. Harrison and the Ministers.

Mr. Russell B. Harrison, president of the Terre Haute, Ind., Street Railway Company, has been having a little argument with the ministerial alliance of Terre Haute in which he seems to have come out ahead. In his desire to give the citizens the best he could in the way of street car service, Mr. Harrison introduced a few innovations. Three weeks ago the newspapers announced that the street railway company would pay for music at Collett Park every afternoon and all day Sunday, and that the Park Commissioners were to be asked to keep the park open at night until 10 o'clock, and to light it with electric lamps. There was also a newspaper paragraph to the effect that the street railway company wanted to introduce a carousal or "merry-go-round."

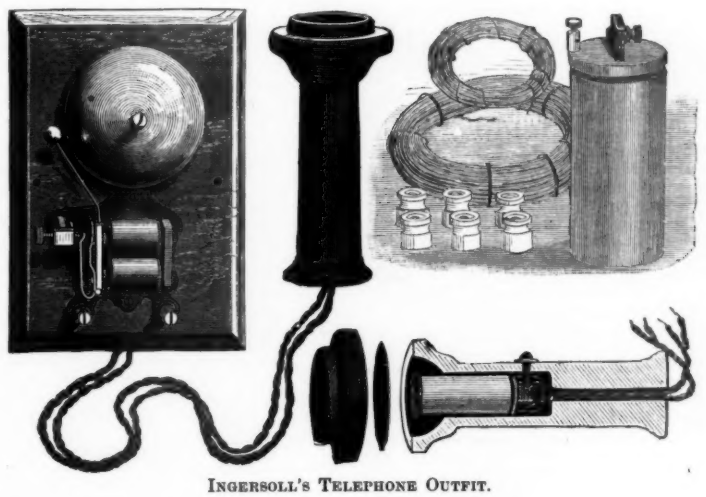
The Rev. Mr. Leech, of the Centenary Methodist Church, thought he saw an invitation for a crusade against vice. He talked with brother clergymen, one of whom went to see the street railway company's president, from whom he learned that there was no intention of putting a "merry-go-round" in the park. Then ensued a further argument, carried on in the newspapers, in which Mr. Harrison was misrepresented as to his motives. The ministers announced that the reason they protested against the carousal after they had been informed that there was to be none was, frankly, that they did not believe what they had been told. By this statement they got the editor of the *Gazette*, who is one of the Park Commissioners, after them. In his newspaper he chided them for being uncharitable, and said that in any event there would have been no danger of a carousal, because the Park Board would not permit one to be set up. About this time Mr. Harrison had extended an invitation to the two orphans' homes to picnic at the park. One home is under the management of the Catholic sisters, while the other is in charge of Protestants. In former years the children in the Protestant home had been given the treat of a picnic, but this was the first time the Catholic children had been invited. On the following Sunday Father McEvoy thanked President Harrison from the pulpit for his kindness.

On the same day, which was the first Sunday following the controversy, the people turned out *en masse* to ride on the street cars to the park. The attendance was several thousand larger than ever before in the history of the resort, and as if to make their endorsement of Mr. Harrison's position plainer, the people went in families—men, women and children.

The Park Board has not yet decided on the proposition to keep the park open in the evening, but will probably decide in the affirmative, the most serious question now involved being the cost of lighting.

The Peerless Telephone Outfit.

A compact and inexpensive telephone outfit, illustrated herewith, has been placed upon the market by Robert H. Ingersoll & Brother, 65 Cortlandt street, New York. The outfit consists of two receiver-transmitters, two call bells, two dry batteries, 150 feet of galvanized iron wire, 50 feet of annunciator wire and six porcelain insulators. The makers state that this is not a toy and they will guarantee its operation on lines up to 1,500 feet in length. With additional battery power the instruments will work satisfactorily over a one mile circuit. The installation and operation of this outfit is extremely simple and the apparatus is well adapted for inside systems or for any use where a central office is unnecessary.



INGERSOLL'S TELEPHONE OUTFIT.

The Schuyler Electric Company.

The committee appointed to solicit subscriptions for stock in the reorganization of the Schuyler Electric Company, of Middletown, Conn., made a very discouraging report at a recent meeting. The amount of money required is too great, although it is thought that the business may be continued on some other basis than the one originally suggested. Other plans will be considered before the project is given up.

A State Electrical Laboratory for Austria.

The Austrian State Normal Standards Commission has decided to establish an electrical laboratory for standardizing purposes in connection to the new buildings which are being erected for the commission.

POSTAL TELEGRAPHERS' BANQUET.

JOHN W. MACKAY PRESIDES AT AN INTERESTING CELEBRATION IN THE NEW YORK POSTAL TELEGRAPH BUILDING.

Two interesting events were simultaneously celebrated in the Postal Telegraph-Cable Company's new building, 253 Broadway, opposite City Hall Park, New York city, on Thursday evening, May 24. The event marked the occupancy of the palatial building by the Postal Telegraph-Cable Company and the Commercial Cable Company, and also recognized the fiftieth anniversary of the sending of the first telegraphic message "What hath God wrought?" which was transmitted between Washington and Baltimore on May 24, 1844.

It was a huge family party, in which none participated except the representatives of the two companies, who gathered about their chief, John W. Mackay, president of the Commercial company, from all the principal cities in this country and from abroad. The tables were arranged in a room on the second floor in the form of the letter U. There were present 140 guests. On the right and left of Mr. Mackay respectively were seated A. B. Chandler, president of the Postal Telegraph Company, and George G. Ward, general manager of the Commercial Cable Company. Other guests at the president's table were Charles Cuttriss, Charles R. Hosmer, of Montreal; John W. Mackay, Jr., S. S. Dickenson, of Canso, N. S.; W. J. Wilmot, of Waterville, Ireland; H. A. Tuttle, of Minneapolis; L. W. Storror, of San Francisco; Richard Irving, Jr.; L. D. Parker, of Chicago; E. C. Platt, treasurer of both companies; E. G. Phillips, of London, Eng.; General E. B. Fowler, George Edward Harding, architect of the building, and W. H. Baker, vice-president of the Postal Telegraph-Cable Company. There was nothing formal about the banquet, and when the coffee and cigars were passed, after President Mackay had made a pleasant welcoming speech, Messrs. Chandler and Ward, as toastmasters, called out their representative men, who each spoke a few words of fellowship.

Within a short time a general public opening of the new building, probably extending over a week, will be held, to which all the friends and patrons of the company will be invited.

LITERARY.

Scribner's Magazine for June contains an article by John Heard, Jr., which, for the first time in accessible form in English, tells the tragical story of "Maximilian and Mexico" in the light of many documents which have recently been published in France.

Whoever is curious to know why it is that few or no old men are found in the great Carnegie steel mills at Homestead, will get his curiosity satisfied by reading a remarkably vivid and exact description of the strenuous life and work there which Mr. Hamlin Garland publishes in the June number of *McClure's Magazine*. Some no less vivid and telling illustrations accompany the article.

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Again we would remark, this is going to be a great electrical construction year.

A very readable bit of electrical fiction is "How Garnesdon Got Electricity," published in the London *Electrical Engineer* for May 11, 1894.

Mr. J. B. Yeakle, a leading citizen of Baltimore, Md., writes to "present my appreciation of the REVIEW in keeping me well posted on current electrical matters."

It is probably not widely known that only seven out of the 17 transatlantic cables are in use—10 having given out from various causes. Estimating the cost of each cable at $3,000,000, here is an irreclaimable investment of $30,000,000 safely buried beneath the ocean to a depth ranging from a few fathoms to over five miles.

ELECTRICITY IN METALLURGY.

According to the *American Manufacturer* the French Consul at Hamburg has sent to his government a report on the new process alleged to be employed in Germany for the production of pig metal and for metallurgical work generally. Our contemporary puts it thus:

According to this process the fusion and casting of metals of various kinds, such as gold, silver, iron, steel, copper, brass, bronze, zinc, platinum, etc., are effected in an apparatus comprising at the same time the smelting furnace and the molds with the object of getting a casting free from pores and blisters. The gas and air are expelled by means of an air pump or by other suitable means before and during the operation. In this way a new method of electrical fusion is economically applied, operating without the employment of coal or coke for the fusion and without the aid of electrodes in the midst of coal, by which this process is distinguished from those actually in use.

The electric current which causes the fusion does not effect it from outside through the walls of a crucible or furnace, but by the metal itself which is to be melted conducting a current through the mass. In this way it has been found possible to melt the ore or metal without overheating the other parts of the circuit of the current, and this not only with a metal easily melted, like zinc, but even Siemens-Martin steel of Swedish origin, the difficulty of fusing which is well known. By means of this process of fusion there is brought about the possibility of getting metals at a profit for casting, and of obtaining also from these metals themselves almost all the heat required in the shape of the work of the current.

It is said that by means of this process the impurity caused in fusion when coal is used is avoided. Moreover, by this method, where coal is absent and there is not an excessive amount of scoria, the quantity of waste or dross is reduced to a minimum. Moreover, by the elimination of oxygen and other liberated gases, the formation of blisters and also oxidation are avoided. The metal gains in fluidity, and on account of there being a vacuum in the molds it yields castings of a close and tenacious nature, even in the case of pieces of small size. In addition to the fact that the process furnishes excellent material for the manufacture of rails and cannon, for the construction of iron bridges and metal for ordinary castings, it also offers, for the reason above given, important advantages for artistic castings, the production of refined pig, and the process of loam casting.

It is said that in producing crucible steel the new process showed an economy of fuel of more than half, which, for metal which is, comparatively speaking, so difficult of fusion and production as steel, constitutes a very favorable result. The iron which is obtained in this way from the ores is very pure, and owing to the fusion being effected without the use of coal or coke, the metal contains much less carbon than ordinary iron and is thus rendered most suitable for the manufacture of steel. The iron which has been thus extracted from ore contains, according to the most recent testimony of the Berlin Academy of Mines, only 2.99 per cent of carbon and this quantity is capable of still further reduction.

Some of this reads like a patentee's specification where he tells what he expects to do rather than what he has done or is doing. Yet, we must observe that the *American Manufacturer* is an authority in metallurgy.

The use of the electric current as the source of heat in metallurgical operations has long been known and is now in daily use in some industries where the circumstances or the necessities point to it as the best. But when it comes to the manufacture of pig-iron from the ore, or billets, blooms or ingots from the pig, it is quite a different question. If there are no electrodes used, as hinted in the quoted article, the heat must come from induced currents set up in the masses under treatment. The usual fluxing agents which assist fusion must be left out because of non-conductivity, hence a higher actual temperature would be necessary for internal fusion by Foucault currents. Vast quantities of such currents must be induced, and if they can be induced where needed, then theoretically some very economical results might be looked for. And such regulation of the flow might be expected to be automatic on the theory that, as parts of the mass get hotter their resistance will rise too and divert the current through the cooler portions, thus bringing up the temperature of the latter. A very pretty distribution of economies might well follow.

Without at present admitting that such a process is capable of commercial adaptation and general use, we can speculate on it as a factor of the world's future possibilities. There is more than mere heat needed in some of our leading metallurgical processes. Take pig-iron, for example. The blast-furnace requires the ore to be mixed with coke and a flux, the result roughly being the de-oxidation of the ore to produce iron, and the combination with this of carbon. Heat electrically produced cannot alone accomplish these results. In making Bessemer or Siemens-Martin steel from pig-iron, the latter is first melted, which might be done electrically, then the carbon is burnt out by a blast of air, and a fixed percentage of carbon is finally introduced by one or another method and the result is steel.

But internally applied or induced electricity cannot alone accomplish such result. In puddling, pig-iron is first melted in the furnace, then an oxidizing atmosphere is admitted to burn out the carbon, the process being tedious by reason of the necessity of working or puddling the mass to allow the air to get at it. Puddling and the Bessemer process differ mainly in the means adopted for bringing air into contact with the molten iron and carbon. In both, as in the blast furnace, electricity alone cannot accomplish the result. No amount of heat alone, however intense or long sustained, can reduce iron ore (oxide of iron) to the metallic iron, so that, after all, it becomes a question of relative efficiency reaching back to the coal-pile. A ton of good coal would give in current, approximately, 700,000 watts for one hour. This could appear, for example, as a current of 14,000 amperes under a pressure of 50 volts. In puddling iron we believe it is not unusual to reckon a ton of coal to the ton of iron. A ton of cast-iron would be a mass 15 inches square and about three feet long. Does it not seem doubtful if 14,000 amperes, or even 70,000 amperes, would *fuse* such a mass down to liquidity?

It is more probable that the French Consul General got hold of the prospectus of some inventor who had in his laboratory experimentally fused some small quantities of iron or other metal, and then drew up a tempting outline of what he was going to do "in the sweet by-and-by."

Foucault fusion may, however, find numerous applications yet where the circumstances are favorable.

CORRESPONDENCE.

OUR BOSTON LETTER.

The town of Reading, Mass., has decided to establish a municipal electric lighting plant for street and commercial lighting and the project will be pushed ahead as soon as definite plans are decided on. The committee having the matter in charge have rendered their report and estimates, both of which were satisfactory, and are now in the market for apparatus and supplies.

Mr. Henry E. Hall, of the Holtzer-Cabot Electric Company, has just returned from a two months' trip through the West and reports the most satisfactory results. His orders for fan motors thus early in the season exceed the entire output for last Summer, and the factory is already being taxed to its utmost capacity. A number of novelties are now under way and will shortly be ready for the market. A revised catalogue containing a full description of these is also on the press and will be ready for distribution about the first of the month.

The Beacon Vacuum Pump and Electrical Company of this city, manufacturers of the "New Beacon" lamp, have opened a branch office in the Hall Building, corner Chestnut and Juniper Streets, Philadelphia, under the charge of Mr. Henry A. Truitt. Mr. Truitt is well known in electrical circles, having been treasurer and manager of the Chittenham Electric Light Company of Oak Lane Station, Philadelphia. He has on hand at the Philadelphia office a full line of samples, which he furnishes free of charge for test. It will be remembered that the Beacon company claim to make the only commercial non-infringing lamp on the market, and Philadelphia has long been a very profitable field for them. Mr. Truitt has recently closed contracts with some of the largest consumers in the State, and the trade will find him always on hand to cater to their wants. At the headquarters of the Beacon company in Boston a healthy activity prevails, and business has never been better than at the present time. This company stands among the first incandescent lamp manufacturers of the country, and the success which has attended their efforts in overcoming the many difficulties of the past year reflects great credit on the management.

Boston, May 26. H. G. T.

OUR CHICAGO LETTER.

The Hyde Park District Telegraph and Electric Company's property and franchises will be sold by the receiver, H. P. Galpin of 21 Quincy Street, Chicago, who is advertising for sealed bids in excess of $1,000. About 51 miles of circuits are in service.

Mr. A. Weinberg, formerly the treasurer of the Adams & Westlake Company, has purchased the stock, patents and good will of the Mosher Electric Company and the Reinman Company, and will hereafter manage both companies. Mr. Weinberg stands well in business circles, and as Mr. Mosher will remain in charge of the lamp factory, we may look for a decided increase in business. The office will remain at 127 Ontario street, Chicago.

The new Mosher lamp is attracting considerable attention and several applications for exclusive territory have already been filed. As is well known the lamp consists only of a frame, cap, base and side tubes, and suspended in one of the latter is a No. 10 Krupp alloy wire having the same relative resistance as No. 16 German silver wire, and tested under a temperature of 600 degrees centigrade. F. De L.

Chicago, May 26.

PERSONAL.

Mr. Morris Mead, of Pittsburgh, was in New York last week.

Mr. H. B. Thayer, New York manager of the Western Electric Company, returned a few days ago from a pleasant sojourn in Europe.

Dr. Geo. H. Benjamin, the alert representative of Siemens & Halske in this country, has just returned from a European tour of several months.

Among the visitors to New York last week were Mr. J. H. Rhotehamel, president of the Columbia Incandescent Lamp Company, St. Louis; Col. J. H. Shay, of the Munson Belting Company, Chicago, and Mr. Morgan Brooks, of Minneapolis.

Mr. Robert B. Fox, late chief engineer of the Atlantic Avenue Railway, Brooklyn, N. Y., has been engaged by the Scranton, Pa., Traction Company. It is the intention of the Traction Company to make a thorough renovation of the system.

It was announced in the New York *Herald*, on May 24, that Arthur W. Field, vice-president of the Peckham Motor Truck and Wheel Company, of New York city, had been married in Chicago, on May 19, to Miss Anna Lucille Work, a well-known spiritualist.

Mr. Samuel Insull, president of the Chicago Arc Light and Power Company, Chicago, is said to be the youngest president of a large illuminating company in the United States. Mr. Insull well deserves the honor of this responsible position, for he is one of the best informed and thoroughly wide awake men in the business.

Mr. Geo. T. Manson, general superintendent of the Okonite Company, returned last week from a seven weeks' tour through the South and West, stopping at New Orleans, Mexico, Los Angeles and San Francisco. Mr. Manson got away from the St. Charles Hotel, at New Orleans, a few days before it was burned, but left part of his wardrobe there and its ashes are still in that vicinity.

Mr. Edward T. Hambleton has retired from the presidency of the Baltimore Traction Railway Company. Gov. Frank Brown, of Maryland, has succeeded him in that position. Governor Brown is the second executive of Maryland to become president of a Baltimore street railway company. Ex-Governor Bowie has been president of the City Passenger Company for about 20 years.

Wall Street and the Electrical Stock Market.

The market this week experienced a natural reaction toward higher values. In the early week the bears continued their campaign, selecting some specialty each day as the center of their attack with a view of weakening the general list. Later a general covering movement set in under a stimulus of London buying, weakening sterling exchange and the settlement of railroad rate difficulties, and improving prospects of a settlement of the coal strike. Trade reports are exceedingly pessimistic. Sales of staples have been lower than at any period since the panic, and there is no prospect of any material improvement during the Summer.

Of the electrical list both General Electric and Western Union were active and weak. Aside from that there was no feature of interest. The lowest price of Western Union was 81¼ on Monday. The highest price was 84½ on Friday. There was a steady rally from the first of the week. The stock was sold on the belief that the dividend for the June quarter would be reduced from 1¼ to 1 per cent, and that the earnings would show a heavy deficit. Semi-official assurance has been given that the earnings for the quarter will be better than is generally expected and be sufficient to pay the full dividend.

General Electric was weak under bear attack. It sold from 36¼ on Monday down to 32½ on Wednesday and subsequently rallied to its highest point. It was one of those stocks which was selected by the bears to weaken the general market. The news regarding the property was favorable rather than unfavorable.

Concerning the company's earnings I learn that it has 3,300 men at work at Schenectady and 1,400, men at Lynn. The company has enjoyed quite a little boom in the railroad equipment business and at the present time has an order for 800 motors on hand, which is about the number booked on May 1, 1893. Considering that the orders compare with a period before the panic its business can be said to be in a good condition. Prices are said to be 30 per cent lower than they were a year ago. This is made up in part by lower wages and cheaper raw material, and in part by less profit in the business.

The company has paid the last of its floating debt, which at the date of its annual report was something over $700,000. The subject of correcting the impairment of capital was discussed at the meeting but no action or agreement resulted.

In view of the fact that the company has given up all idea of reducing its capital to correct the capital impairment, taken in connection with the strength in the debenture bonds in face of the weakness of the stock, I have heard it intimated, as hinted in this column last week, that the policy of the company is to correct the impairment by retiring its debenture bonds. Its surplus is not available for dividends until this impairment is corrected.

What would be more natural, under the circumstances, than to retire the $10,000,000 debenture bonds outstanding with the surplus as it accrues? These bonds stand as a charge against the assets. Were they wiped out the assets would be increased that amount, which would be within about $2,500,000 of correcting the impairment. Moreover, these bonds at the present market price could be purchased for a figure somewhat less than $9,000,000. It is believed that, should the bonds be wiped out, the balance of the impairment could be easily provided for so as to allow the company to return to the dividend list.

Of the less active electrical securities in the New York market, North American sold between 3¾ and 4; American Telegraph and Cable at 88¼ to 89½; Interior Conduit and Insulating was bid 50 and held at 55; Postal Telegraph and Cable was bid 60 and held at 65.

On the Boston Exchange, Westinghouse securities fell off slightly, the assenting being quoted at 36 bid and 36½ asked, and the first preferred 50¾ bid and 52 asked. The company will take action on its preferred dividend about the middle of June. I hear the opinion expressed that a dividend on the common stock at the same time will be very probable. The company has a large surplus in cash, and now that its business is on a thorough systematic basis, and is steadily improving, the common shareholders should participate in a division of the earnings.

On the Boston Exchange, Bell Telephone was steady around 190; Erie Telephone was quiet between 44 and 45; and General Electric preferred between 60 and 65, with few transactions. New England Telephone advanced from 56 to 59. Fort Wayne was bid 2 and held at 2⅞.

The Cincinnati Edison Electric Light Company, which was absorbed four years ago by the Cincinnati Gaslight and Coke Company, has begun a suit against the latter corporation for an injunction to prevent the gaslight company from voting stock of the electric company. It is claimed that the gas company's managers will vote the stock to elect the gas people as officers of the electric company and run the electric company in the interests of the gas company, to the detriment of the interests of the electric company's stockholders. Bain.

New York, May 26.

The Corliss Engine Company.

The engine building industry in New England will receive a boom shortly in the resumption of work by the Corliss Engine Company, of Providence, R. I. This immense plant has been shut down for a year and a half, but the company has now been reorganized, and the new management will make a determined effort to reinstate it in its old position as one of the leading engine plants of the country. The head of the corporation is David M. Thompson, master engineer of the great cotton manufacturing firm of B. B. & R. Knight, and associated with him are some of the best known machine manufacturers in Massachusetts. Among these are S. Holman, Gen. Wm. F. Draper, William H. Bent, H. C. Perham, P. W. French, George R. Babbitt and Charles E. Giles. The officers are David M. Thompson, president and treasurer; Stephen A. Jenks, vice-president; William B. Sherman, secretary; Charles E. Giles, agent, and L. H. Wattles, superintendent. The capital invested in the Corliss plant, the buildings of which cover over nine acres, amounts to more than $2,000,000, and in ordinary times they furnish employment to 2,000 men.

The storage batteries used on the Cummings electric carriage, described on page 269 of this issue, are the improved chloride accumulators, made by the Electric Storage Battery Company, of Philadelphia.

Spirit of the British Electrical Press.

Mr. Henniker Heaton, it is said, looks forward to the time when every private house in England will be supplied with a telephone service for £3 a year, and when it will be possible to speak with America and Australia. Mr. Heaton is certainly very sanguine. —*London Electrical Engineer.*

The Heilmann electric locomotive, described in London *Engineering*, Vol. LV pages 772, 806 and 836, was tried recently on the Western of France railway. It drew a special train from the St. Lazare terminus, in Paris, to Mantes, a distance of 33 miles, which was covered in 55 minutes. The train consisted of five ordinary coaches and dynamometer car. It is stated that a speed of 65 miles per hour was attained on certain portions of the line.

At the end of 1893 some 700,000 ten candle 35 watt lamps were connected to the mains of the London companies. At the recent meeting of the Metropolitan Electric Supply Company, the district of which is a fairly representative one, it was stated that each lamp connected yielded a revenue of 8*s.* 9*d.*, and, with the Board of Trade unit at 7¼*d.*, this means that each lamp must have been alight some 400 hours. Taking this as an average figure for London, we find that these 700,000 ten candle lamps give the portentious total of 2,800 million candle hours.—*London Electrician.*

The London, Brighton and South Coast Railway, says London *Science Siftings*, has come to the conclusion that the electrically lighted trains are more serviceable than those lighted by gas, chiefly because it is unnecessary to haul them to the charging stations, as is required by the latter. The electrically lighted trains are always ready for use, and are estimated to render about 15 per cent more service than the others. The first cost of gas for a train of 10 carriages, including buildings and apparatus, is given at from £700 a train; of oil, about £120 a train; and of electric light, £400. The expense of maintenance with gas is about £120 a year per train; with oil, from £70 to £130; and with electricity, £50. The figures for electricity give the average for 30 trains.

A correspondent writes to the London *Electrical Review* as follows:

Last year I exhibited a mock electrical machine at several concerts and entertainments named "The Electrolickedisonintophitsaphone" (ELECTRO-LICK-EDISON-INTO-PHITS-A-PHONE). The machine in question consisted of an oblong case covered with switches and instruments, and projecting from the front of this case were iron funnels. This case was stood over a trap-door in the stage. A humerous dictation on the marvels of electricity was then given by a lecturer, who introduced the machine as the wonder, not only of this age but of all ages. Men and boys by turn got into the box, and on certain switches being turned on, almost any sound under the sun was mimicked. A great feature was a real German band. A final experiment was the turning on all the switches, when a fearful noise was heard like thunder, and the whole case flew into pieces and colored fire and electric sparks burst forth, much to the horror of the discomfited lecturer, who rushed wildly from the platform.

Electricity as an illuminant has slowly been coming to the front in competition with other species of lighting and, according to figures supplied by the Crystal Palace District Electric Supply Company, its cost is less than that of gas alone. The total domestic expenditure for gas for one year is selected as amounting to £13 3*s.* 10*d.*, or including oil and candles, a total of £18 8*s.* 10*d.* During the same period, and replacing these three illuminants, the cost of electric light is given as in 1892–93, £15 14*s.*, in 1893–94 as only £10. The manner of arrangement of the installation has, according to this report, a great deal to do with the annual expenditure. In 1891 the amount received by the Metropolitan Electric Supply Company per eight candle-power lamp connected was 13*s.* 7*d.*; in 1892 it had been reduced to 11*s.* 1*d.*; by the Westminster Supply Company it was in 1891, 12*s.* 7*d.*; in 1892 the cost was 9*s.* 7*d.*, and in 1893 7*s.* 9*d.* per eight candle-power.—*London Industries and Iron.*

There really seems to be no end to the possible applications of electricity to chemical industrial operations, and, although I have already noted many of them in these columns from time to time, I have yet a new departure to record. It is the recent progress made by Siemens & Halske, of Berlin, in their apparatus for the generation of ozone and its utilization in the bleaching of potato starch for commercial purposes. M. Scheurer has recently reported that the "soluble starch" and "refined starch" made by this firm are perfectly white, and have a greater thickening power than ordinary potato starch of the best quality. It would appear that the action of the ozone is something more than a mere bleaching process, as the "thickening" made from starch prepared by its use does not lose its consistency on standing as an ordinary starch emulsion does. The new process, therefore, comes as a boon to the finisher of calicoes, who has for a long time been at a loss to know what to do to prevent his pastes from turning sour and useless so rapidly. The dextrines manufactured by the same plant are also of a better color than most varieties of British gum obtained by acid or by the old-fashioned roasting process.—*London Lightning.*

Breed's emergency wagon, made by the New England Engineering Company, of Waterbury, Conn., is rapidly coming into popular favor among electric railway managers who desire their repair equipment to be of the best. A great advantage of the Breed wagon is that one man can raise the tower in nine seconds with one hand.

ELECTRIC RAILWAY NOTES.

A trolley road for Cambridge, O., is under consideration.

The right of way for the Gordon Heights, Del., Electric Railway has been obtained.

Congressman Charles D. Haines has become interested in the proposed new electric road from Troy, N. Y., to Sandlake.

The Milwaukee, Wis., Street Railway Company will extend its lines to Whitefish Bay if a bonus of $18,000 can be raised.

New York letter carriers are trying to obtain free transportation when on duty over the surface and elevated roads in the city.

Governor Flower has signed a bill making the fare on the Manhattan elevated roads in New York city five cents between the Battery and points North of the Harlem River.

Farmers along the projected Springfield and Urbana, O., Electric Railway are becoming interested. One of them, Abe Mumper, will pay $1,000 when the first car passes his house.

The Alley L Road, of Chicago, has put one of its locomotives in the hands of an inventor, who claims that he has discovered a practical method of using compressed air for motive power.

D. F. Keenan, of Meriden, Conn., has signed a contract with the Hartford Street Railway Company to build the extensions to Windsor, Poquonock and Rainbow, and, perhaps, to South Windsor.

Work has been commenced on the St. Joseph & Stevensville Electric Street Railway, at Benton Harbor, Mich. The road will be about six miles long and be ready for the cars about the first of July.

A mortgage deed of all the property of the Union Traction Company in Rhode Island to the Central Trust Company of New York was filed at Providence on May 21. The deed is to secure an $8,000,000 bond issue.

President Russell B. Harrison, of the Terre Haute, Ind., Street Railway Company, says that he is just now engaged in the all-absorbing problem of hustling for coal. He has 15 days' supply ahead and intends to keep ahead if he can.

The question of having an electric railroad in New Brunswick, N. J., has been taken up by the Board of Trade, and the majority of its members have expressed their approval of having the pending railroad ordinance passed over the veto of the Mayor.

The directors of the West End Street Railway Company of Boston, have declared a semi-annual dividend of four per cent on the preferred stock and three per cent on the common stock, payable July 2 to stockholders of record at close of business June 9. Books close June 9 and reopen June 25.

Henry M. Whitney, of Boston, denies the story, locally published, that he has purchased a controlling interest in the Fairfield and Waterville Electric Road, nor does he know anything about the proposed through electric road between Boston and Bangor.

Ex-Judge Jamieson, on behalf of the North and West Chicago street railway companies, has filed two $50,000 bonds, as required by the trolley ordinance recently granted. The contracts for changing from horse to trolley have been let, and the work will begin at once.

It is expected that the sale of the Sioux City, Ia., Street Railway Company will not be confirmed by the courts for several weeks. The affairs of the company are moving quite satisfactorily under the receiver, and is now thought that at least sixty days will be required to organize the new company.

The New Hampshire Legislature is to consider a project which involves the building of an electric road the entire length of the Granite State, beginning at Haverhill and ending at Quebec, in Canada. Its main patronage is expected to come from Summer tourists, and it will open up a section of the country noted for its scenic grandeur.

The Sprague Electric Railway and Motor Company has brought suit against the Steubenville, O., Street Railway Company, and five Steubenville stockholders who had one share each. They ask for a receiver. They allege that there is a mortgage of $70,000 on the track, equipment, etc., and that the same is not worth $15,000.

The regular monthly meeting of the Massachusetts Street Railway Association was held at Young's Hotel, Boston, on May 17, about thirty members being present. Col. John H. Cunningham presided. After dining, the members listened to remarks by Hon. Amos F. Breed, of Lynn; Hon. E. P. Shaw, of Newburyport, and Hon. Charles B. Pratt, of Worcester.

The Jarvis-Conklin Mortgage Trust Company has applied to the District Court at Kansas City, Mo., for a decree of foreclosure of the first mortgage indebtedness of the Northeast Electric Street Railway Company, amounting to $260,000. It alleges that default has been made in the payment of interest on the first mortgage. Several creditors have filed intervening petitions. The largest of these is for $20,000, filed by the Westinghouse Electric & Manufacturing Company.

At the annual meeting of the stockholders of the Atlanta, Ga., Consolidated Street Railway Company the following directors were elected: S. M. Inman, H. A. Inman, H. E. W. Palmer, Capt. Harry Jackson, W. C. Sanders, R. J. Lowry, Joel Hurt, J. T. Dargan, J. H. Watson, of New York; E. Woodruff and G. Carroll Payne. The directors elected these officers: Joel Hurt, president; E. Woodruff, vice-president and general manager; R. J. Lowry, treasurer; T. K. Glenn, secretary and assistant treasurer, and H. N. Hurt, superintendent.

NO TALKING UNDER THE OCEAN.

A CABLE A FOOT THICK WOULD BE NEEDED FOR A TELEPHONE LINE TO EUROPE.

It was Prof. Sylvanus Thompson, of London, that set electricians talking again about what is known as submarine telephony. He was in the United States some months ago and he declared his belief that a cable so constructed as to make what the electricians call self-induction balance and neutralize certain other elements of difficulty in the problem world render it possible to talk from the Old World to the New. Practical electricians see small prospects of results from Professor Thompson's suggestion, as it would cost some millions of dollars to test the accuracy of his theory. He admits that his special form of cable would be costly and difficult to make and lay.

It is generally held by electricians that a cable with a thick enough conducting core properly insulated would carry the human voice under the ocean. Some electricians guess that the cable, insulating coat and all, that should carry speech under the Atlantic must be a foot in diameter. This is arguing from known facts, but unforeseen difficulties might arise. When the electrician has taken into account all he knows he is sometimes balked in practice by the development of things that he does not know. The building of such a cable, or of that suggested by Professor Thompson, is believed to be a long way off.

The only man who has suggested a method of sending human speech under the ocean by means of cables now in use is J. J. Carty, a widely known electrical engineer of this city, who set forth his theory in a lecture about five years ago. Another man thought the idea of sufficient practical importance to have it patented. When Mr. Carty thinks so perhaps the other fellow will hear from him.

When a telegraph operator cables across the Atlantic there is an appreciable length of time between the communication of the impulse here and the recording of it on the other side, and the second impulse must be withheld until such time has elapsed. For this reason the human voice cannot be directly transmitted by cables now in use, for a single syllable would communicate hundreds of tiny impulses to the cable, and they would jostle one another, so to speak, in such fashion that no clear record would be made upon the other side. Mr. Carty suggested that the message be first talked into a phonograph upon one side of the Atlantic; that the phonograph then be connected with the cable, and turned at so slow a rate that the impulses shall not crowd one another. A slowly moving phonograph on the other side would receive the message, and, having its record, would be revolved rapidly enough for the sounds to be received by the human ear.

Mr. Carty believes his plan perfectly sound in theory, but he admits that it would take a long time to send such a message. No experiment has been tried to demonstrate its practicability, partly because Mr. Carty is too busy earning a living in the service of a telephone company to take six months off for devising the necessary machinery for the experiment, and partly because the cable companies are not likely to trouble themselves about such a matter.—*New York Sun.*

Brooklyn Electric Railway Strike Ended.

The strike or lockout on the Atlantic Avenue Railway Company's trolley system in Brooklyn, N. Y., which was begun on May 20, because the motormen refused to buy new uniforms, came to an end on May 22. According to the terms of settlement, every discharged employé who cared to do so reported for duty and was immediately taken back. The chief concession made by the company was that no motorman should be obliged to buy a new uniform as long as the one which he now wears is in presentable condition. The company also agreed that it would require the motormen to wear only blouses and caps, and that, in the future, they should buy them wherever they chose.

General Electric's New Directors.

The directors of the General Electric Company have elected Robert Treat Paine, 2d, and Gordon Abbot, both of Boston, as directors to fill the two new seats created by the stockholders at their annual meeting. The old officers have been elected with the exception of M. F. Westover who was chosen secretary. The directors at a meeting last week discussed the matter of the impairment of the capital stock, and referred it to the executive committee.

Telephonic Communication in India.

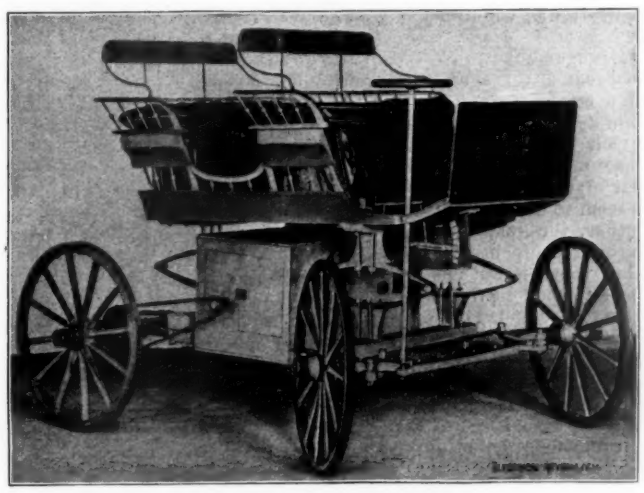
It is stated that the Great Indian Peninsula Railway Company has established telephonic communication between the different offices in their station yard at Poona. Another railway company, the Bombay, Baroda and Central India, has also established a system of telephonic communication at its workshops at Parel.

The Cummings Electric Carriage.

Mr. G. K. Cummings, a well-known electrician of Chicago, has recently finished and put on the streets of that city an electric carriage, illustrated herewith, embodying the latest and best designs for successful and commercial operation. The primary objective points seem to be strength, positive action of the driving apparatus and simplicity.

The inventor claims that for practical commercial purposes an electric carriage should be built so as to be capable of withstanding the same shocks, jars and rough handling that the ordinary city hack or carriage is subjected to; and that weak construction, such as steel tubing framework, bicycle wheels, rubber tires, etc., although lightening the load and increasing traction, are unreliable, which is a feature to be especially avoided.

An examination of the accompanying illustration will show that the gearing is positive and direct in action, while the use of the link belt allows a certain flexibility which practice has demonstrated is necessary. The speed is under perfect control by means of the foot pedal actuating a switch under the forward part of the carriage, and the direction of the carriage is so easily controlled by the hand wheel that a child can direct it, and the various parts so accessible and simple that after a few moments' instruction and explanation a novice can operate the vehicle.



THE CUMMINGS ELECTRIC CARRIAGE.

The motor is a two horse-power series wound 24 volt machine. The end of the armature shaft carries a rawhide pinion, engaging with an iron gear on a counter shaft directly connected with the rear axle through a link belt. The rear wheels are both driven, but when the vehicle turns a corner or deviates from a straight course, by an ingenious device through a system of hardened steel roller clutches, either driven wheel may move independently of the shaft or the other wheel, so that the one on the outside of the curve will automatically adjust its speed to the distance it has to traverse. This difference of speed of the two driven wheels is considerable, as on the sharpest turn the periphery of the inner wheel covers only half the distance traveled by the outer one. The front axle is made of aluminum bronze, is rigid, and carries two short supplemental movable axles, to which are attached the front wheels. The movable axles are connected to each other by a pivoted iron bar, so that their action is reciprocal. The inner end of the right-hand one is toothed, engaging with a pinion on the end of the shaft carrying the hand wheel.

The framework of the running gear is of angle iron, supporting four springs placed longitudinally with the body of the carriage, which has a seating capacity of four people.

The current needed is derived from 200 ampere hour storage battery cells placed under the seats of the carriage. The brake is a leather-lined steel band clutch.

Recent tests of this carriage are reported to have shown that over level city roads, at a normal speed of 10 to 12 miles an hour, a maximum average of from one and one-quarter to two electrical horse-power is all that is required, the difference in power consumed depending on the state of the roads and the style of paving traversed. The questions of running through the mud, over street car tracks, raised obstructions, such as manhole covers and the like, starting up from ruts and gutter, have each been taken up carefully in turn, and through practical experience and actual operation it has been demonstrated that the vehicle successfully and easily overrides such obstacles.

Rogers' Search-Light Annoys Hotel Guests.

Mr. Rogers' big advertising searchlight, which was formerly on top of the Pulitzer building, New York city, is now perched on the roof of a tall building running through from Broadway to Fifth avenue just below Delmonico's. The guests of the Coleman House, in Broadway, last week objected to Mr. Rogers throwing the penetrating rays of his searchlight on the Twenty-seventh street side of the hotel. They said the light kept them awake, and if the blinds were drawn down they got no ventilation in their rooms. The proprietor of the hotel made a complaint against Mr. Rogers. Some merchants in Broadway had Mr. Rogers before Justice Ryan in the Jefferson Market Court not long ago. They said that the light thrown upon their building was a nuisance, and asked that it be abolished. Justice Ryan then warned Mr. Rogers against throwing his light on buildings where he had not the proprietor's permission.

The fastest track in the world—where Nancy Hanks made a mile in 2.04—is at Terre Haute, Ind. The Vigo Agricultural Society offers some very large purses, $90,500 in all, for a great harness race meeting to be held at Terre Haute, August 13 to 18 next. The Terre Haute Electric Railway, of which Russell B. Harrison is the president, is interested in the success of this event, and they want electrical men to come to the meeting and at the same time inspect the modern electric road to be seen at Terre Haute.

UNIPOLAR DYNAMOS FOR ELECTRIC LIGHT AND POWER.

(*Concluded from page 263.*)

From equation (4) $D = 24.28 =$ diameter armature in inches.

Second—To design a direct-connected dynamo to generate 130 volts at 200 revolutions per minute for light and power purposes. As before we have

$$D = 214.4.$$

These figures show the immense possibilities of the unipolar dynamo, possibilities so immense, indeed, that the practical difficulty is not in the design of the dynamo, but in the design of the steam engine. Two machines like the last coupled at the ends of the shaft of a 100,000 horse-power engine would supply more current than is at present consumed in any two cities in the world. Nor is the excessive current a disadvantage, for while we would point out the tremendous capacity of one of these dynamos, there is no necessity for running them at their maximum output. Even if we diminished the current to one-hundredth its ultimate value and only use a 1,000 horse-power engine to drive the dynamo, the loss due to the resistance of the armature will still be only four or five per cent.

A more economical way of supplying current for light and power, however, would be to design unipolar dynamos of less current-carrying capacity and less voltage, and then join in series on the same shaft as many as are needed to produce the required electro-motive force. For example, we may generate 130 volts by joining in series on the same belt-driven shaft two dynamos each giving sixty-five volts at 800 revolutions per minute.

The dimensions will be as follows:

$$D = 75.81.$$

Running this combination at one-tenth of its ultimate capacity by means of a 1,250 horse-power engine, we should still have a very high efficiency.

Methods of taking off the current.—The best means of making electrical connection with the revolving armature is a very important, but somewhat difficult, matter. A great many devices have been tried or suggested. The principal of these are brushes of copper gauze or carbon, and mercury contacts applied to the edges of the disk or tube. Belts or straps made of flexible sheet copper or copper wire cable have also been used. One application of this latter device consists in connecting together two armatures by such a belt whereby the electro-motive force of the two machines are added together and, if necessary, the mechanical power for driving one or both machines can be transmitted by this same belt. There would not seem to be any great difficulty in applying brushes to a unipolar dynamo; in fact for a given current it would seem to be a much easier problem than with a direct current machine having a commutator, since the former has a continuous and smooth bearing surface for the brushes instead of the somewhat uneven surface of copper and mica which exists on a commutator. It is a fact that the speed may be very high, but with the perfectly smooth surface and by the use of brushes with light pressure and composed wholly or partly of graphite or some friction metal which might even be lubricated it would appear to be possible to take off a current sufficient for almost any electric light or power use. If the very high speed makes the friction too great to permit of the use of brushes, the edge of the tube or disk may be arranged to run in a mercury trough, thereby making a good electrical contact with very little friction. In this case, however, provision should be made to prevent the mercury from being thrown off by centrifugal force, as by the use of a guard ring extending all round the edge of the tube or disk. Another device would consist of ball bearings applied to the shaft or to the periphery of the disk or cylinder. These might perform their ordinary mechanical function and also serve to take off the current.

Method of Driving.—There are various mechanical arrangements available for connecting a unipolar dynamo to the source of power. The simplest would be to connect the dynamo to the engine by means of ordinary leather belting, either with or without the use of a countershaft. In this way a high speed can be easily obtained if desired and is perfectly permissible, since the solid disk or tube of steel which constitutes the armature is capable of a much higher speed of rotation than the ordinary built-up form of armature now used. It would probably be safe to have a solid steel armature run at two or four times the speed of the ordinary armature having the same diameter.

If the dynamo be directly coupled to the engine the speed of the latter and the diameter of the armature may be most economically proportioned to give any desired voltage by the application of the previous equations.

An arrangement which seems to possess great advantages would consist of a steam turbine running at 10,000 or 20,000 revolutions per minute, which is the ordinary speed of such machines, directly coupled to a unipolar dynamo. These two machines seem to be admirably suited to each other, the very high speed of the turbine compensating for the fact that there is but one inductor. This combination entirely avoids the necessity for reducing the speed of the engine by gearing, which is done in the case of the Laval turbine, or the risk which is involved in running a wire-wound armature and sectional commutator at a speed of 10,000 or more revolutions per minute, which is the plan adopted with the Parsons' turbine.

Advantages of unipolar dynamos and motors.—The greatest advantage of the unipolar machine is its extreme simplicity. Its armature consists of nothing but a solid cylinder or disk of steel, or other suitable metal, firmly mounted upon a shaft. We have only to compare this construction with that of the ordinary armature consisting of hundreds of pieces of sheet iron, bolted or otherwise held together to form the armature core, and wound with a great many turns of wire or bars of copper, which have to be thoroughly insulated from each other and which are not very securely held in place. In addition to this we have the commutator consisting of fifty or more sections of copper, separated by strips of mica and held together by nuts, etc. The electrical connections between the armature and commutator also add to the complication. In short, it would be difficult to find any two pieces of machinery in which the contrast between simplicity and complication is greater. The construction of the field magnet and the rest of the machine is also very simple. The elimination of the commutator, although already mentioned in connection with simplicity, is, nevertheless, an essential feature of this type of machine, and is a great advantage. The almost infinitesimal armature resistance of these machines is decidedly advantageous, not only in increasing efficiency and decreasing heating, but also because it causes the machine to regulate more closely either as a dynamo or as a motor. According to all accepted theories there would be no hysteresis in these machines, because both the armature and field are always magnetized in exactly the same direction and to exactly the same intensity.* For similar reasons there would be no Foucault currents, since the electro-motive force generated in any element of the armature would be exactly equal to that generated in any other element and there could be no tendency to produce eddying currents. This perfect uniformity of the magnetic field is secured by the construction, which is exactly symmetrical, the air gap being precisely the same at all points.

The question of armature reaction is somewhat doubtful since some authorities state that it is quite considerable, but in the opinion of the authors it is very small, and certainly no greater than in other types of machine. The armature consists of only a single turn, consequently the maximum magnetizing effect of the armature in ampere turns is numerically equal to its current capacity, and since the ampere turns on the field would be made considerably greater than this, the armature reaction cannot be great. It is interesting to consider how armature reaction can occur in such a machine. The probability is that it has the effect of curving and slightly lengthening the lines of force so that they do not pass perpendicularly from one pole surface to the other in the air gap and have a spiral path in the iron, since the field current tends to produce lines in planes passing through the axis, and the armature current acts at right angles producing an inclined resultant. There can of course be no change of distribution of magnetism as a result of armature reaction, which is the really objectionable effect that it produces in the present types of machines, and in the unipolar machines there are no back ampere turns and no magnetic leakage.

In conclusion we may say that the unipolar machines are practically indestructible, since they are so simple and so strong that they are not likely to be damaged mechanically and it is almost impossible to conceive of one being burnt out or otherwise injured electrically, since the engine would be stalled by the enormous current before the armature could be fused by it. A machine possessing all these important advantages certainly deserves a prominent place in electrical engineering, whereas it now has practically no existence whatever.

* There might be some molecular friction due to cutting the lines of force, but this would probably be slight.

That $50,000 Prize.

Recent developments regarding that $50,000 prize offered last March by the Metropolitan Traction Company for an underground electric road suitable for New York city lead us to think that the offer was not made in a sincere spirit. Prize offers of this kind should be accompanied by a certified check. Prizes offered for professional work are seldom satisfactory to either party. The most recent example of this fact is the rejection of all the plans submitted in competition for a new city hall in New York. Such legislative action has been taken that it appears probable that none of the competing architects will get a cent for their labor. In the case of the Metropolitan Traction Company it seems to have been a lack of legislative action, intentional or otherwise, which caused the trouble.

TELEPHONE NEWS AND COMMENT.

Red Wing, Minn., has granted a franchise to the Northwestern Telephone Company.

The annual meeting of the Erie Telegraph and Telephone Company will be held in New York, on Tuesday, June 12.

The Massachusetts House has referred to the next general court a bill introduced by Mr. Bliss, of West Springfield, to tax telephone companies upon miles of wire instead of miles of line.

An ordinance has been introduced in the City Council at Marietta, O., which, if passed, will give a franchise for erecting poles and wires for a telephone exchange to F. S. Shurick, a lumber dealer.

The output of the American Bell Telephone Company for the month ending May 20, 1894, was as follows:

	1894.	1893.	Inc.	Dec.
Gross output.....	8,974	10,951	....	1,977
Returned.....	5,310	5,195	115	....
Net.....	3,664	5,756	....	2,092
Since Dec. 20:				
Gross output.....	31,899	43,059	....	11,167
Returned.....	28,379	23,122	5,257	....
Net.....	3,520	19,937	....	16,417

Columbus, O., expects to soon be included on the New York-St. Louis long-distance telephone line, and is much pleased thereat. On the day the New York and St. Louis lines are connected a great celebration of the event will be held for which preparations have already begun to be made along the line.

The Broadway cable people have just placed alongside their tracks a most complete telephone system to be used as a safeguard against runaway accidents. One might ride up and down the road all day without noticing the telephone, but there they are right in the middle of the street with stations 600 feet apart.

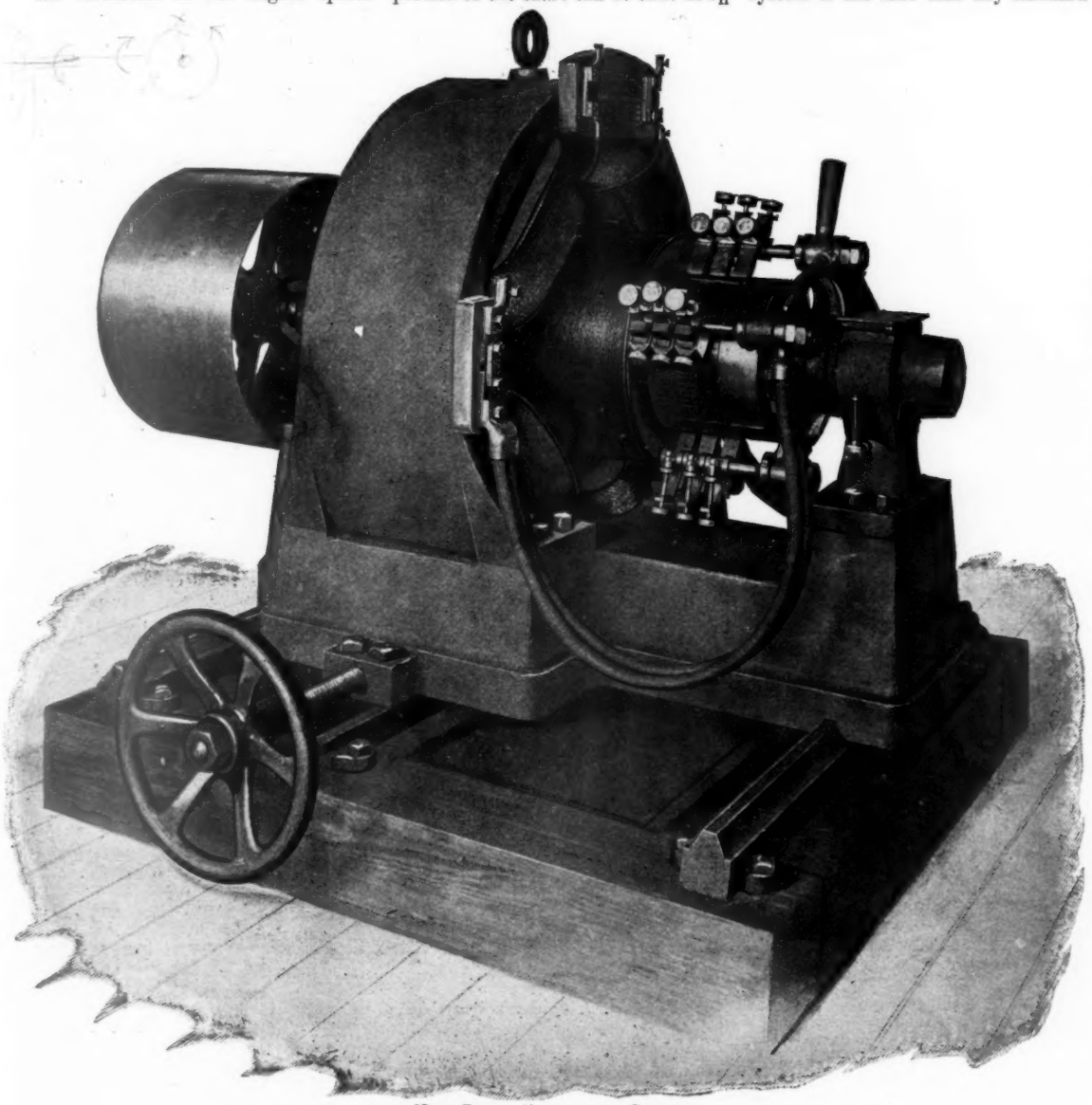
Mr. J. W. Cherry, who has been manager of the telephone exchange in Toledo, O., for some time past, is to leave to accept a promotion in Columbus. The gentleman who is to succeed Mr. Cherry as manager is Mr. Joe Brennen, who is also a favorite and, like his predecessor, accepts a promotion. Mr. Brennen has worked up from a messenger boy to his present position and has been a faithful emyloyé of the company.

Mr. M. G. Kellogg has filed a suit in the Henderson, Ky., Circuit Court against the American Bell Telephone Company and the Great Southern Telephone and Telegraph Company, asking an accounting and a receiver for the latter company. Kellogg asserts that he owns $82,600 of stock in the Southern company in which the Bell company owns a controlling interest. He says the Bell company has forced the Southern into unnecessary expenditures and has passed the dividend, seeking in every way to depreciate the stock and force other stockholders to sell out.

New Riker Multipolar Dynamo.

The Riker Electric Motor Company, 45 and 47 York street, Brooklyn, N. Y., has recently placed upon the market the new multipolar dynamo illustrated herewith. This machine is an incandescent generator, working at 125 volts pressure. The base is of cast iron, and the field magnet of cast steel, with inwardly projecting radial poles. The field is of one piece in the small sizes, and is split in the larger sizes to facilitate handling the armature.

These generators are compound wound for constant potential, with an allowance of one or two per cent rise for variations in the engine speed.



NEW RIKER MULTIPOLAR DYNAMO.

A drum type armature, with the plates mounted upon and directly keyed to the shaft, is used. No bolts pass through the core plates. The wires lie in milled grooves, and mica-nite cloth or pure mica insulate the core from the wire. The electrical balance is maintained even with one or two sets of brushes removed as the armature coils are all cross-connected in parallel grouping. The commutator is heavily built, the bars being clamped between steel cones and insulated with mica.

These machines are of the highest grade mechanically and electrically, and have been designed to facilitate installation, as well as to present a good appearance. They can be supplied in sizes from 10 to 100 kilowatts.

The Arnold System of Electric Power Station Construction.

Mr. B. J. Arnold's system of electric power station construction, illustrated and described in the ELECTRICAL REVIEW for May 16, 1894, is especially applicable to arc lighting stations where, as it is well known, a large number of small electrical units must be used, owing to it being usually necessary to run a machine for each arc light circuit.

In the case of a 1,000 horse-power combined incandescent and arc light station, a high speed engine directly connected to the shaft is placed at each end of the line shaft, the shaft being detachable from each engine, parting at its center so that either portion of the shaft can be shut down in case of a hot journal, while the other portion of the plant remains in running order. The generators are mounted on quills carried in independent bearings, and motion is transmitted to the generator by means of positive jaw clutches. When the generator is not running there is absolutely no wear upon the shaft, no side strain by the pulling of belts, or no friction clutch pulleys to get out of adjustment. The strain on the shafting is purely torsional, thus permitting it to be small in diameter and making it much less liable to get out of alignment.

When it is desired to start any generator, it is brought up to speed as a motor, and when it attains the same speed as the line shaft, a positive clutch, operated either by hand or by electricity, is thrown into connection, after which the current is reversed through the machine and it immediately becomes a generator.

Any generator in the plant can be started and stopped at will, without stopping either engine, or without using belts, pulleys or friction clutches, thus having all the flexibility and reliability of the ordinary low speed lighting station, wherein shifting and belting are used, and occupying not over one-quarter the amount of real estate that such a plant ordinarily covers. This permits a very much less expensive building to be constructed, less investment in real estate, greater ease in operation on account of having fewer wearing parts to lubricate and maintain, and less labor to operate the plant.

Another important feature of the system is the fact that any standard make of dynamos and engines can be utilized, thus necessitating no radical departure from the present lines of manufacture. For this reason many of the present plants can be rebuilt to conform to this system and utilize a large part of their old equipment.

President Edward Maher of the Union Railway Company, of New York City, has announced that the trolley line of the Westchester Electric Company is completed from Fordham through Williamsbridge and South Mount Vernon to New Rochelle and will be put in operation for the first time on May 30, Decoration Day. The fare for the trip from New Rochelle to Third avenue and 129th street or to Eighth avenue and 135th street will be 10 cents.

ELECTRIC LIGHT FLASHES.

The electric light plant belonging to the city of Bangor, Me., is now running by steam power.

The Wilmington, Ill., council have been debating the advisability of purchasing the electric light plant.

It is proposed to use the water power of the river at Williamsport, Pa., for an electric light and power plant.

It is expected that the new low tension arc lighting system of the Brooklyn, N. Y., Edison Electric Illuminating Company will be in operation by June 1.

The $14,000 electric light plant installed four years ago at Clarksville, Tenn., has been sold to a new company for $6,000, and $10,000 will be spent on improvements.

The question of issuing $50,000 bonds in the interest of an electric light plant will be again submitted to the people of Hamilton, O., in the nature of an election June 2.

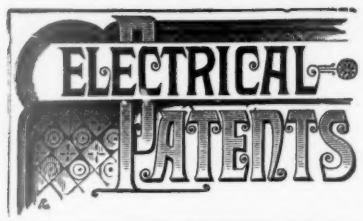
The Wilmington City, Del., Electric Company will purchase Riddle's Mills, on the Brandywine, and transform it into an electric station, using the Brandywine water-power for the generation of electricity.

The plans for the increase of capital of the Hartford, Conn., Electric Light Company have been perfected. Four new shares may be had at par by each holder of ten old shares raising the stock from $250,000 to $350,000.

General Jackson, president of the Nashville, Tenn., electric street car system, reports that he has made a five-year contract with the Cumberland Electric Light and Power Company by which this company will furnish power to operate the street cars.

At a special town meeting held last week to see if the town of Reading, Pa., would establish and operate an electric light plant of its own for lighting the streets, and also for commercial purposes, the committee reported that they could build a plant with a brick power station, 90x45, with machinery, with 41 miles of wire for $41,000. The town voted unanimously to establish an electric light plant of its own, and gave the committee further time to investigate the best methods and plant.

Vice-Chancellor Bird, at Trenton, N. J., has granted an injunction forbidding Franck Z. Maguire, Frank A. Magown and others from disposing of $75,000 worth of the common stock of the Trenton Light and Power Company. The General Electric Company, of New York, claimed that this stock was issued to Maguire and Magown when the new electric light company, started by them about two years ago, consolidated with the local electric light company under the name of the Trenton Light and Power Company. Maguire, it is charged, acted as agent of the General Electric Company, and that, under an agreement between Magown and himself to divide the profits, the company is entitled to one-half of the $150,000 worth of stock issued to them on account of the new company.



INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON MAY 15, 1894.

519,715. Hand regulator or switch for motors; Emil E. Keller, Chicago, Ill.

519,718. Gate for pneumatic dispatch tubes. 519,719. Pneumatic dispatch tube system; Samuel F. Leake, Philadelphia, Pa., assignor to the Leake Pneumatic Transportation Co., same place.

519,726. Electric arc lamp; Wilhelm Mathiesen, Leipsic, Germany.

519,794. Electric railway system; David Mason, Schenectady, N. Y.

519,813. Electrically governed switch; Emil H. E. Klatte, Freiberg, Baden, Germany.

519,837. Trolley wheel; Van Dyke Cruser, Flatbush, N. Y.

519,849. Alternating current arc lighting system; Thomas Spencer, Philadelphia, Pa.

519,858. Constant current dynamo; William H. Elkins, Cambridge, Mass.

519,862. Method of and means for starting synchronous motors; Benjamin Lamme, Pittsburgh, Pa., assignor to the Westinghouse Electric Manufacturing Co., same place.

519,869. Electric mechanism for giving reciprocating motion. 519,870. Magnetic engine for reciprocating tools; Henry S. Mackay, Boston, Mass.

519,876. Telephone circuit; Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Co., same place.

519,881. Device for regulating electricity generated by means of wind power; Theodore A. Willard, Norwalk, Ohio.

519,912. Electric arc lamp; Jesse F. Kester, Buffalo, N. Y., assignor to the F. P. Little Electrical Construction and Supply Co., of New York.

519,932. Electric railway signal; Pollin M. Strong and Charles F. Reed, Omaha, Neb.

519,938. Electric railway signal; Frank Beatie, Leete Island, Conn.

519,945. Electric indicator; Wilbur E. Garey, Chicago, Ill.

PATENTS EXPIRING MAY 15, 1894.

190,684. Galvanic batteries; C. R. Jennison, Boston, assignor to himself and E. K. Hall, Needham, Mass.

190,898. Quadruplex telegraphs; Geo. B. Prescott, New York, N. Y.

PATENTS ISSUED MAY 22, 1894.

520,033. Electric battery; William W. Burnham, Newton, Mass., assignor to the Electric Gas Lighting Co., Portland, Me.

520,044. Coin controlled electrical apparatus; John O. Frost, Greeneburg, assignor of one-half to Minnie Johnson, Uniontown, Pa.

520,050. System of electrical conversion and distribution; Thomas H. Hicks, Detroit, Mich.

520,061. Railway signal device. 520,062. Apparatus for Controlling the Movement of Railway Trains or Vehicles; Frank E. Kinsman, Plainfield, N. J.

520,068. Telephone; Harry F. Slocum, New York, N. Y., assignor to the New York Electrical Development Co., of New York.

520,072. Pedal governor for electric motors; Arthur G. McKee, State College, Pa.

520,083. Telephone trunk line system; John I. Sabin and William Hampton, San Francisco, Cal.

520,088. Incandescent lamp; Frank S. Smith, Pittsburgh, Pa.

520,106. Transmitting sound; Harry B. Cox, Hartford, Conn.

520,108. Electrical train brake; Wendell C. Fletcher, St. Louis, Mo., assignor to Norman P. Willard, trustee, Chicago, Ill.

520,111. Electric locomotive; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Co., of Connecticut.

520,116. Electrical primer; William Mason, New Haven, Conn., assignor to the Winchester Repeating Arms Co., same place.

520,120. Galvanic battery; Edwin F. Northrup, Ardmore, assignor to Queen & Co., Philadelphia, Pa.

520,127. Electric annunciating apparatus; Horace E. Walter, Richfield Springs, N. Y., assignor by mesne assignments to the National Electrical Manufacturing Co., Milford, Conn.

520,128. Switch for high tension circuit. 520,129. Electric current indicator; James J. Wood, Fort Wayne, Ind.

520,143. Former for winding armature coils; Harry L. Kirker and William Chambers, Pittsburgh, Pa., assignors to the Westinghouse Electric and Manufacturing Co., same place.

520,152. Dynamo electric machine or electric motor; Robert K. Welch, Philadelphia, assignor of one-half to George E. Schlegelmilch, same place.

520,156. Electric railway trolley; Thomas M. Brown, Cleveland, O.

520,184. Electric clock striking mechanism; Fred. L. Gregory, Chicago, Ill.

520,206. Uterus battery; Charles S. W. Hinckley, San Antonio, Tex.

520,213. Trolley wire hanger; Thomas J. McTighe and Sumner W. Childs, New York, N. Y.

520,223. Electric advertising or signaling apparatus; Geo. L. Schneider, San Francisco, Cal., assignor of seven-eights to Wm. J. Pattosien, Fred. L. Waibel, Chas. Fisher, Geo. Brandt, Gus. A. Paul, Fred. Brandt and A. R. Paul, same place.

520,228. Electric locomotive; Rudolf Eickemeyer, Yonkers, N. Y.

520,232. Electric arc lighting system; Daniel Higham, Boston, Mass., assignor to the Higham Electric Co., Portland, Me.

520,246. Automatic telephone system; Louis E. Simoneau, Montreal, Canada, assignor to the Automatic Telephone and Electric Co. of Canada, same place.

520,253. Electric heater for car sand-boxes; John M. Christopher, Baltimore, Md.

520,257. Electrolytic cell; Thomas Craney, Bay City, Mich.

ADVANCE INFORMATION.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies, new telephone companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

Electric Light and Power.

ST. AUGUSTINE, FLA.—The General Electric Co., capital $50,000; has applied for incorporation to build and operate electric light, heat and power plant. Wm. A. McWilliams is president and J. A. Enslow is secretary and treasurer.

MOUNT AIRY, N. C.—Address the Mayor for information concerning electric light plant to be established.

VICTORIA, TEX.—Address the Mayor concerning proposed electric light plant.

READING, MASS.—Reading Gas and Electric Co., incorporated, capital $50,000; manufacturing and dealing in gas and electric lights, heat and power.

STONEHAM, MASS.—Stoneham Gas and Electric Co., incorporated, capital $50,000; manufacturing and dealing in gas, electric light, heat and power.

CAMDEN, N. J.—Consolidated Electric Improvement Co., incorporated, capital $100,000; manufacturing electric appliances.

PRINCETON, KY.—Eugene Young and A. B. Sanders are organizing a company for the erection of an electric light plant and waterworks system.

BRAMWELL, W. VA.—Bluestone Electric Light Company electric light plant leased to H. P. Mercer for a term of three years.

OSHKOSH, WIS.—The Board of Public Works is negotiating for the lighting of the city by electricity.

CAMDEN, N. J.—Block Heat and Light Company; capital, $100,000. Incorporated by Samuel K. Robbins and others.

COLUMBUS, OHIO.—A bill has been introduced in the Ohio Legislature appropriating $100,000 for the erection of an electric light plant at the State penitentiary.

LONDON, CAN.—Address A. Ormsby Graydon, city engineer, concerning contract for electric lighting of the city for a term of one, three, five or eight years.

PITTSBURGH, PA.—The Pittsburgh Automatic Lighting Company; capital, $25,000. Incorporated by C. H. Cobbell and Lawrence Wolfel.

LANCASTER, WIS.—Meyer & Shawalter are asking for exclusive franchise for 15 years to operate electric light plant. These parties will be in the market for the necessary equipment when the matter of franchise is settled.

NEWBERRY, MICH.—The Upper Peninsular Asylum for the Insane is to add an electric light plant, and is about to purchase the necessary equipment.

ELKHART, IND.—The Home Electric Light and Power Company have been given the contract to put in 75 arc electric lights for street lighting.

ROME, N. Y.—Address Architect Jacob Agne concerning electric motor and electric lighting apparatus, dynamo, etc., for new county almshouse.

TOPEKA, KAN.—Address Architect J. W. Perkins, 720 Kansas avenue, concerning electric lighting apparatus for the Santa Fe hospital.

WASHINGTON, D. C.—J. Vernon Campbell, president of the Campbell & Zell Company, of Baltimore; Eugene W. Tucker, Milwaukee, Wis.; and others, are organizing a new electric light and power company.

CHICAGO, ILL.—The Gregory-Reed Company; capital, $60,000. Incorporated by Jacob H. Gregory, Wm. S. Reed and others. To contract for building electric light and water works plants.

PINE BLUFF, ARK.—The Southwestern Light and Improvement Company; capital, $500,000. P. M. Harding, president; C. H. Ledlie, manager; Max Reber, assistant-manager; W. A. Lee, cashier. Purchased by and is a part of Pine Bluff Water, Gas and Electric Light Company.

FORSYTH, GA.—An electric light system is under consideration costing $7,000. City Clerk R. G. Anderson will give information

ATHENS, GA.—An electric light plant will probably be erected, costing $15,000.

SAVANNAH, GA.—The plant of the Brush Electric Light and Power Company will be enlarged at a cost of $50,000.

MILFORD CENTRE, OHIO.—An electric light plant is to be constructed. Bids were opened on the 11th instant, but contract has not yet been awarded.

New Electric Railways.

CHICAGO, ILL.—Co-operative Electric Railway Company, incorporated; capital, $1,000,000. Incorporators, Morris S. Evinger, Charles E. Burnap and Isaac T. Dyer.

PHILADELPHIA, PA.—The Central Electric Railway Company, of Philadelphia and Delaware County, incorporated; capital, $60,000.

PHILADELPHIA, PA.—Citizens' North End Street Railway Company; capital, $36,000. Incorporated by F. Weckerly and others.

BUTLER, PA.—The Butler Traction Company; capital, $75,000. Incorporated by Jos. Hartman and others.

OPELIKA, ALA.—The Opelika and Auburn Electric Railway Company are in the market for equipments. Address C. I. Daughty.

PHILADELPHIA, PA.—The Citizens', Clearfield and Cambria Street Railway Company, incorporated; capital, $6,000. Geo. S. Gandy, 51 North Sixth street, will give information.

TAMAQUA, PA.—The Inter County Street Railway Company, incorporated; capital, $200,000. Operating electric street railway.

BANGOR, PA.—The State Belt Electric Street Railway Company, incorporated; capital, $200,000.

AKRON, OHIO.—The Akron and Cuyahoga Falls Rapid Transit Company; capital, $300,000. Incorporated by Robert Randolph and others, to construct and operate an electric street railway from Ravenna to Barberton.

NEW YORK, N. Y.—Esmond Electric Traction Company, incorporated; capital, $1,000.000.

HOLYOKE, MASS.—People's Electric Street Railway Company, incorporated; capital, $100,000.

PITTSBURGH, PA.—Sylvan Avenue Passenger Railway Company, incorporated; capital, $12,000. Operating electric railway.

ST. AUGUSTINE, FLA.—The St. Augustine Electric Railroad Company is preparing to build an electric plant at North Beach to operate its road.

New Telephone Companies.

INDIANAPOLIS, IND.—Indiana Telephone and Construction Co., incorporated, capital $300,000.

WASHINGTON, D. C.—The Agricultural Department, until June 6, is inviting proposals for the purchase of 180 miles of telegraph line, extending from Titusville to Jupiter, Fla., comprising poles, wires, insulators, battery cells, tools, etc.

JERSEY CITY, N. J.—The Harrison International Telephone Construction Co., incorporated, capital $200,000.

HIGHLAND, N. Y.—West Shore Telephone Co., incorporated, capital $3,500.

LORAIN, O.—Black River Telephone Co., incorporated, capital $1,000.

STATESVILLE, N. C.—The Statesville Telephone Co. has been organized by A. K. Klingender, James T. Tindall and A. B. Cooper, who have been granted franchise to construct and operate telephone line and exchange.

NEW BRITAIN, CONN.—The Hardware City Telephone and Electrical Co., incorporated, capital $500; manufacturing electrical telephones, etc.

FORT WAYNE, IND.—Fort Wayne Postal Telegraph Co., incorporated, capital $20,000.

PORTLAND, ORE.—The Multnomah Telephone Co. has been incorporated with a capital of $100,000. Organizers are Edward W. Curtis, Charles Perry and P. Dolan.

PORTLAND, ORE.—National Telephone Co., incorporated, capital $100,000.

New Manufacturing Companies.

SAN FRANCISCO, CAL.—Electrolytic Reduction Company, incorporated; capital, $1,000,000. Mining and reducing ores.

TOLEDO, O.—The American Electric Co., incorporated, capital $10,000; manufacturing electrical apparatus, etc.

JERSEY CITY, N. J.—The Wireless Armature Dynamo and Motor Company, incorporated; capital, $100,000. Manufacturing electrical machines and devices.

HOBOKEN, N. J.—The Chesley Electric Company, incorporated; capital, $100,000. Manufacturing electrical machinery and appliances.

PORTLAND, ORE.—Portland, Vancouver and Northern Railway Company, incorporated; capital, $3,000,000. Constructing railroads, telegraph and telephone lines, etc.

CLEVELAND, OHIO.—The Fletcher & Fletcher Electric Company has been incorporated; capital, $10,000.

TRENTON, N. J.—The Geneva Construction Company, incorporated; capital, $25,000. Constructing railroads, electric light plants, etc.

JERSEY CITY, N. J.—The Dewey Electric Signal Company, incorporated; capital, $60,000. Manufacturing machinery for producing electricity.

MILWAUKEE, WIS.—Milwaukee Electric Launch Company, incorporated; capital, $10,000.

ST. LOUIS, MO.—The Western Electric Accumulator Company has been incorporated with a capital of $10,000.

ALL KINDS PRICES & PARTS Dynamos and Motors AND PARTS OF SAME TELEPHONES ELECTRICAL SUPPLIES SEND STAMP FOR CATALOGUE PALMER BROS. MANUS. CONN.

C. F. SPLITDORF,
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(Armature and Magnet Winding a Specialty.)
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A new IRON BUILDING for immediate shipment, 81 ft. wide, 200 ft. long, consisting of a main span 61 ft. wide with leanto on one side 20 ft. wide.

The trusses are sufficiently strong to carry a line of shafting and light jib crane.

This building is suitable for a Machine Shop, Tin Plate Mill, Rolling Mill, etc. For further information, address

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